BADHAMIA UTRICULARIS Berk.

Plasmodium spreading on glass, stained with picrocarmine, magnified 15 times.

Part of the same, showing nuclei, magnified 400 times.
A MONOGRAPH
OF THE
MYCETOZOA
BEING
A DESCRIPTIVE CATALOGUE
OF THE SPECIES IN THE
HERBARIUM OF THE BRITISH MUSEUM.

ILLUSTRATED WITH SEVENTY-EIGHT PLATES
AND FIFTY-ONE WOODCUTS.

BY
ARTHUR LISTER, F.L.S.

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PREFATORY NOTE.

THE collection of specimens of Mycetozoa in the Herbarium of the British Museum has been greatly increased in recent years. The additions include the large collection of the late C. E. Broome, bequeathed by him to the Museum, and that of H. W. Ravenel, purchased from his widow.

It was necessary to make a critical examination of the whole of the materials in the Herbarium. Mr. Arthur Lister, who has devoted much attention to these organisms, was fortunately able to undertake this work; and he agreed at the same time to prepare a monograph of the whole class based on this examination.

This volume, the result of his labours, contains descriptions not only from the specimens in the Museum, but also from types in various public and private Herbaria, and from his own rich collection. Mr. Lister has generously presented a large series of specimens to the Museum, so that the Herbarium now contains types of all the species described by him in this monograph.

The volume is fully illustrated with plates mechanically reproduced from faithful water-colour drawings by the author and by his accomplished daughter, to whom in the Introduction Mr. Lister acknowledges his obligations.

WILLIAM CARRUTHERS.

November, 1894.
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INTRODUCTION.

Fries gave the name of Myxogastres, in 1833, to the group of organisms described in this Monograph, placing it among the Gasteromycetous Fungi. In 1836 Wallroth substituted the term Myxomycetes (Schleimpilze) for the older name, and this came to be the generally accepted designation. Later investigations showed that the spores, instead of producing a mycelium, as in the case of fungi, gave birth to swarm-cells, which coalesce to form a plasmodium. In consequence of this discovery, which indicated a relationship with the lower forms of animal life, de Bary in 1858 introduced the name Mycetozoa. Under this head he still retained the term Myxomycetes for the section so named by Wallroth, but linked with them the Acrasieae of Van Tieghem, a small group inhabiting the excrement of animals; in these the spores are said to produce swarm-cells, as in the Myxomycetes, which multiply by division but do not coalesce to form a plasmodium. At a certain period, when the fruits are about to be formed, they become attached in branching strings which concentrate to a point, where they are massed together in aggregations of more or less definite shape; the swarm-cells, however, do not lose their individuality. In Dictyostelium, a genus of the Acrasieae, a stalk is formed by the arrangement of a number of swarm-cells in vertical rows in the centre of the heap; the surrounding amœboid bodies creep up this stalk and form a globose cluster at the extremity; here each amœboid swarm-cell acquires a spore-wall, and they become a naked aggregation of spores not enclosed by a definite sporangium-wall. Rostafinski followed de Bary in the view that the formation of a plasmodium indicates a wide separation in the natural position of the Myxomycetes from the fungi, but he suppressed that name entirely, adopting de Bary's class name Mycetozoa in its place; at the same time, he admitted into his Monograph Dictyostelium, a genus of the Acrasieae. The reason for his including this genus may be the fact pointed out by de Bary, that Brefeld in first describing the dense aggregations of swarm-cells into the stalked spore-masses of Dictyostelium, refers to them as being "plasmodia; that is, products of the coalescence of swarm-cells;" and it was not until after the publication of Rostafinski's
Monograph that Van Tieghem in 1880 and Brefeld in 1884 corrected this view. Accepting the Mycetozoa as established by Rostafinski, but excluding Dictyostelium on the ground of its not forming a true plasmodium, we have a clearly defined group of organisms separated from all others by the following combination of characters. A spore provided with a firm wall produces on germination an ameboid swarm-cell which soon acquires a flagellum. The swarm-cells multiply by division and subsequently coalesce to form a plasmodium which exhibits a rhythmic streaming. The plasmodium gives rise to fruits which consist of supporting structures and spores; in the Endosporae these have the form of sporangia, each having a wall within which the free spores are developed. A capillitium or system of threads forming a scaffolding among the spores is present in most genera. In the Exosporae the fruits consist of sporophores bearing numerous spores on their surface.

The Spore and Swarm-cell.—The spores of the Endosporae are mostly spherical, but occasionally they are ellipsoid. Their size is uniform in each species, or with so little variation that their measurement affords a valuable character for specific determination. This is not without exception; for instance, in the abundant species Leocarpus fragilis the spores are commonly 11 to 12 μ diameter, but in occasional gatherings they average 16 to 20 μ. In other genera which present ample material for comparison, similar variation is sometimes met with. The spore-wall is variously coloured in the different species. It is described by Zopf as showing the chemical reaction of cellulose, and consisting of a simple firm membrane;* but the spores of several species of Didymium and Trichia, when crushed in an acetic solution of gentian-violet, show the existence of two layers, the inner more delicate and appearing less deeply stained than the outer. In Physarum, Arcyria, and genera with thin-walled spores, the double layer has not been traced. It is either smooth or marked with sculpture. The contents of the spore consists of faintly granular protoplasm with a single central nucleus. In abnormal developments, monstrous spores, often of irregular shape and containing several nuclei, are of frequent occurrence.

The length of time that elapses before the germination of the spore after it has been placed in water varies with the species, and often in different gatherings of the same species. In the darker spores of Stemonitis fusca it does not begin for nine or twelve hours, while in the pale-spored variety it has been observed to occur in twenty-eight minutes. In Reticularia Lycopodium it usually takes place in less than an hour in fresh gatherings; spores from a specimen which had been stored for nearly three years began to germinate in four hours, and in twenty hours nearly every spore had done so. Didymium difforme

produced abundant swarm-cells in twenty-eight hours, after three years and nine months from the date of collection, and in a few days all the spores appeared to have germinated, and plasmodia were formed in a moist chamber. Sporangia were developed eleven days after the sowing of the spores. The spore-wall is ruptured by the swelling of the contents, which slowly emerges through the opening, and in about ten minutes lies as a nearly pellucid globule by the side of the empty membrane; after remaining quiescent for a few minutes amoeboid movements begin to take place, and shortly afterwards the flagellum is produced. This is at first a somewhat tentative process, and the flagellum is frequently withdrawn; but in about a quarter of an hour it acquires its full length of about 15 µ, and by its lashing strokes the swarm-cell swims off with a dancing movement. At this stage it is pyriform in shape, the interior body-substance is granular and contains a contractile vacuole, and often one or more vacuoles in addition which do not usually show contraction. At the narrow end is placed the nucleus, which can easily be recognised by its lighter and more homogeneous appearance and central nucleolus. The nucleus does not alter its position, though constant movement is observed among the constituents of the granular part. The whole is enclosed by a layer of hyaloplasm devoid of granular particles, and of extreme tenuity over most of the surface, but thicker at the anterior end, where it is produced into the flagellum immediately in front of the nucleus, and also at the posterior end, where it often extends in a brush of two to eight more or less slender pseudopodia. In addition to the dancing motion, which is maintained as long as they are free in the water, the swarm-cells when they come to rest exhibit movements of an amoeboid character, and spread with an irregular outline; or they assume a linear form and creep over a level surface with a snail-like motion, the flagellum being extended in advance. In this position the movement of the interior substance is seen to advantage. In the large swarm-cells of Amaurochete atra it may almost be described as streaming, the granules passing from one end to the other in constant flow; the hyaloplasmic extension at the posterior end continually changes its form and often detaches portions which cannot
be distinguished from the rest of the hyaline element, and appear to contain refuse matter. After a time the creeping movement is again exchanged for the dancing. In all cultivations of germinating spores, a number of the swarm-cells, after a short period of activity, withdraw the flagellum and become encysted in a globular form, as the microcysts of Cienkowski. After being dried and re-wetted, the contents bursts the membranous cyst-wall, which remains as an empty hyaline sac, and emerges to resume the swarm-cell form. If bacteria are introduced into a cultivation of swarm-cells on the stage of the microscope, they are seen to be laid hold of by the pseudopodia and drawn into the body of the swarm-cells, where they are enclosed in a digestive vacuole. Several bacteria are brought in turn to the same chamber, or fresh captures are conveyed into one or more additional vacuoles. The protrusion of pseudopodia usually ceases after such ingestion, and that part of the swarm-cell takes a rounded form. In the course of an hour or two the bacteria are assimilated, and the digestive vacuoles disappear. Unicellular algae and inorganic matter are sometimes taken in, which after a time are again discharged. Both ingress and egress are observed to take place only at the posterior end.* De Bary stated that swarm-cells derive their support only from nutrient matter in solution,† and it may be that they are to some extent nourished in this manner; but considering the large number of species belonging to different genera which have been observed to prey actively on bacteria, it cannot be doubted that these form an important part of their food.

Bipartition of the swarm-cells is observed to begin in a few hours after they leave the spore-membrane, and we may conclude with de Bary that the process is frequently repeated, for it may be seen constantly taking place for three or four consecutive days in cultivations, during which time the numbers increase very largely. The bipartition is preceded by the withdrawal of the flagellum and the swarm-cell taking a spherical form. The nucleus then divides by karyokinesis. The earliest stage which I have observed is that of the nuclear-spindle with an equatorial

† De Bary, "Comp. Morph. and Biol. Fungi, Mycet.," etc., p. 452.
INTRODUCTION.

...plate and an indication of spindle-fibres converging at the poles; at a later stage the swarm-cell becomes ellipsoid and a constriction appears in the middle. As bipartition proceeds the nuclear plate divides and the two halves separate, the connecting achromatic fibres being often discernible. The daughter-nuclei at length retreat to the opposite poles of the swarm-cell, which in about a quarter of an hour from the beginning of the process of constriction is completely divided. A flagellum is in a short time produced by each daughter-cell, which then assumes the original form of the parent. After dividing in the manner described, through a period of uncertain duration, they withdraw the flagellum and creep with slow ameboid movement. When two of them come in contact with each other they may coalesce; others congregate at this point and form a centre to which great numbers converge, and though they may remain distinct for some time, ultimately unite and mingle into one moving mass, the plasmodium of Cienkowski.

There is no doubt that the young plasmodia exercise a distinct attracting influence on the swarm-cells in their neighbourhood. Many ameboid swarm-cells, after remaining some time near the plasmodium, contract and form into microcysts, in which state they are enclosed by the plasmodium and become surrounded with vacuoles, where they are gradually digested. Although the fusing swarm-cells thus lose their individuality, their nuclei, so far as has been observed, remain distinct. For example, eight swarm-cells may be counted uniting and forming a plasmodium, and their eight nuclei can be afterwards distinguished; but when this number is exceeded the movements of the plasmodium and the inconspicuous nature of the nuclei present difficulties in the way of their recognition. Whatever reason there may be from general considerations to regard this fusion of individuals as akin to conjugation, no fusion of nuclei, which appears to be an essential part of the process, has yet been observed.

In the *Exosporace* represented by the single genus *Ceratiomyxa*, the spore is ellipsoid, and consists of granular protoplasm, in which four nucleus-like bodies can often be observed. This is enclosed by a membraneous and colourless spore-wall. On placing the perfectly matured spores in pure water, the membraneous...
wall is seen almost immediately to slip free from the protoplasmic contents, often with a sudden jerk, and by this action may be removed to some distance from the now naked spore, while it retains its original form as an empty transparent sac.*

The naked spore remains from six to nine hours without any apparent alteration; at the end of this time a slow amoeboid change of outline is observed, sometimes accompanied by the projection of numerous pointed pseudopodia, and a constriction begins to appear in the middle portion. As this continues, a second constriction can be noticed in each half. The first division may now become complete, but usually the whole of the spore contents remains united until a further constriction takes place in each quarter, and in about an hour from the time when the first movement was observed the original ellipsoid body is divided into eight spherical portions. These occasionally become free at this stage, but as a rule they continue attached to one another by narrow bridges; a few minutes later each protrudes a flagellum, and assumes the pyriform figure of a swarm-cell; then by the united lashing movement of their flagella the cluster of eight swarm-cells swims away. They may remain connected for an hour or more, but eventually become detached, and resemble in all respects the swarm-cells of the Endosporeae.

The Plasmodium.—The phenomena which are met with in the swarm-cell may be seen in the plasmodium on an extended scale. Like the amoeboid phase of the former, it is endowed with power of locomotion, and advances over the substratum with a creeping movement. The interior substance consists of granular proto-

* I have not observed the emergence of the spore-contents in an amoeboid form through an opening of the spore-wall as described by Faminzijn and Woronin, "Ueber Ceratium hydroides, Mem. Acad. Petersbourg," xx. 3, 1873.

**Fig. 4.—Ceratium Xa mucida Schroet.**

a. Spore.
b. Spore-contents escaping from the spore-wall.
c to g. Successive stages in the division of the naked spore to eight.
h. Cluster of eight swarm-cells.
Magnified 1200 times.
plasm, containing numerous nuclei and vacuoles. The latter vary in size, and are often seen to contract and discharge their contents, which is either watery or contains refuse matter. The movements in the interior of the swarm-cell are extended into a system of circulation in the plasmodium, which spreads in a network of veins with a few principal channels. Through these the granular substance streams in a rapid torrent which gradually comes to a pause in the space of a minute and a half to two minutes; it then immediately reverses its course, maintaining a rhythmic flow, backwards and forwards at nearly equal intervals, but always of a somewhat longer duration in the direction in which the plasmodium is creeping. This movement is continued through the smaller veins which branch with increasing intricacy till lost in the broad stratum ending at the tumid margin of the advancing wave. The whole is invested by a layer of hyaloplasm devoid of granular particles, but merging imperceptibly into the inner stratum. The hyaloplasm exhibits amœboid movements, projecting and withdrawing pseudopodia, and is unequal in thickness over different parts; it is generally abundant at the advancing margin, and a large residuum of substance free from granules and charged with refuse matter is left behind, marking the track where a plasmodium has passed. The hyaloplasm appears to be a more firm condition of the protoplasm assumed when exposed on the surface; how far it may have reference to the rhythmic streaming of the plasmodium, or what causes that movement, has not been ascertained.

The description given above applies to plasmodia which creep over dead leaves or the surface of logs or woody fungi. Those which inhabit the interior of rotten wood usually emerge only at the time of fruiting, and then appear as cushion-like masses or as scattered globules. The plasmodia of the Calcareae contain granules of calcium carbonate (designated "lime"), in addition to the protoplasmic particles. The granules vary in abundance in different species, being small and inconspicuous under the microscope in some, while in the opaque white plasmodium of Chondrioderma Micheli the, they appear like crowded glass beads 2 μ or more in diameter, and greatly impede the streaming movement. The colour varies in different plasmodia; it is for the most part white, yellow, or pink, in some it is purple or green, but is generally constant in each species. An exception occurs in Trichia fulva, which usually rises from rotten wood in rosy pink globules, but frequently the plasmodium is watery white; the two colours are not met with together in the same growth, but the sporangia from each are identical in all characters. Dianema depressum has, as a rule, a white plasmodium, but occasionally it is pink.

De Bary states that "union never takes place between plasmodia of different species," * and my own experience is in accord

* De Bary, I.c., p. 426.
with this statement; the cases of hybridism referred to by Mr. Massee in his Monograph* appear to require confirmation.

The food of plasmodia is often easy to determine. Those which live among dead leaves spread with veins which are brown from the incorporation of decayed vegetable matter, and when the refuse is discharged they become white or yellow, according to the species, shortly before they form into sporangia. The plasmodium of Badhamia panicola thrives on the inner bark of felled elms, and is difficult to discern on the red-brown substratum owing to the broken fragments of bark with which it is densely charged; it becomes pure white by the rejection of enclosed matter before fruiting. Occasionally the question of food is somewhat obscure; for example, the plasmodium of Amaurochete atra rises in cushions from half an inch to two inches in diameter, from the hard and apparently sound wood of Scotch firs; that of Stemonitis splendens may also be found emerging from the sawn surface of fir stumps, which show no sign of decay, and covering an area of six to seven square inches. Whatever solid matter these plasmodia may have ingested has been parted with before leaving the wood, but it appears more probable that their food was absorbed in a state of solution. The yellow plasmodium of Badhamia utricularis is the only one we are acquainted with which feeds on living fungi and is capable of being cultivated without limit on Stereum hirsutum and allied species; it can be observed under the microscope to dissolve fungus hyphae as the hyaline border of a wave of plasmodium advances over them.† The growth of this species is often very rapid; a plasmodium measuring about a square inch in area on a large pileus of Auricularia mesenterica has been seen to increase during twenty hours so as to cover more than six square inches; the vigorous flow extended over the meshes between the veins and produced an unbroken surface.

The multiplication of nuclei which takes place in such a growth as this, where we may assume, from numerous observations, that they have increased at least sixfold, requires further investigation. That they sometimes divide by karyokinesis is

* Mass., Mon., p. 15.
proved by the case described by me in *Journ. Linn. Soc.*, vol. xxix., p. 541. In that instance a plasmodium of *B. utricularis* growing on *Auricularia mesenterica* partly spread in a network of veins over two large coverslips; the films were killed with Flemming's fluid, stained with safranin, and mounted in Canada balsam. In these two preparations the nuclei are seen to be dividing by karyokinesis; the stages represented are the nuclear spindle, and where the nuclear plate has divided and the two halves are connected by achromatic fibres. Part of the same plasmodium spread over another coverslip, and was killed and stained with the others. The nuclei in this preparation have the appearance most commonly met with, containing a central nucleolus, and without any indication of karyokinetic division. The main body of the plasmodium continued to creep over the *Auricularia* for several days after these observations had been made.

This experiment affords clear evidence that under certain conditions the nuclei of the actively streaming plasmodium divide by karyokinesis, but what these conditions are remains at present unexplained. The process no doubt is a rapid one, occupying about half an hour; but the following observations confirm the conclusion arrived at from many previous experiments, that it is not the only way by which the nuclei increase in number. A further growth of the plasmodium already referred to as increasing sixfold in twenty hours, spread over two pilei of *Auricularia* in the course of fourteen hours; during this period a portion of the plasmodium was taken every quarter of an hour, and smeared on a thin coverslip and stained. Each of the fifty-five mountings shows the nuclei in the usual vast abundance, implying that their numbers had increased, *pari passu*, with the growth of the plasmodium, and in none of them is there any appearance of karyokinetic division. From previous observations of the length of time occupied by the karyokinetic process we are satisfied that it could not have escaped detection if it had occurred during those fourteen hours. The multiplication of nuclei which we are bound to assume had taken place must therefore have been produced by some other means. They vary in size from 2·5 to 5 μ, and the great majority contain a single sharply defined and deeply stained nucleolus, which is seen to be connected with the nuclear-wall by delicate threads.
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In a few instances a large nucleus encloses two nucleoli, and occasionally there are appearances which strongly suggest that simple division of a nucleus is taking place. Some days later, when the plasmodium had ceased to feed, and was collecting together to form into sporangia, stainings showed the nuclei more equal in size, measuring 4 to 5 μ in diameter. This experiment may be taken to add materially to the negative evidence, to say no more, that under some conditions the increase in the number of the nuclei is produced by simple division.

The plasmodium of the exosporous Ceratiomyxa issues from the interior of rotten wood to form cushion-like heaps which rapidly extend into columnar or branching sporophores. As the streaming movement common to both divisions of the Mycetozoa is not described by Famintzin and Woronin in their valuable paper on Ceratiomyxa before alluded to, the following observations may be given. Rounded cushions of plasmodium were placed on a cover-slip, supported at the margins by wet blotting-paper, and were thus enclosed in a moist chamber. The plasmodium spread in a film over the glass, and here eventually an abundant growth of spores was produced. At the earliest stage that could be observed under the microscope the plasmodium was seen to be sharply differentiated into two elements—a hyaline part which ultimately forms the principal constituent of the gelatinous column, and the granular protoplasm containing numerous small nuclei. In the film on the cover-glass the granular substance spread in a network of veins through the hyaline portion. Through these veins the protoplasm streamed in rhythmic flow, first in one direction and then in the other, at the same intervals of time as in the Endosporae.

The Sclerotium.—Superficial plasmodia may pass into the resting stage or sclerotium, and this change may be induced by exposure to dry air. In some cases, however, it occurs when water and apparently food material are present, and the cause for the change is then difficult to discover. When the plasmodium of Badhamia utricularis is dried, the streaming movement gradually ceases, and the granular particles collect in clusters, surrounded by a border of hyaloplasm; the refuse matter is thrown out, and a membranous cyst-wall forms round each cluster of granules, which also includes 10 to 20 nuclei; the cysts become agglomerated into thick masses of irregular shape, drying to a horny consistence.* The changes of outline seen in the maturing sclerotia cannot be merely the effect of shrinking from drying, and as under the microscope we frequently observe the cysts along the margin of a forming sclerotium creep among each other with amœboid movement, it is probable that this movement takes place throughout the mass. The sclerotium of this species can be revived after preservation in a dry state for three years, by

being placed in water; that which has been lately formed resumes the streaming condition in a few hours; when of greater age it requires to be kept wet for some days before the movement begins; the cyst-walls are then absorbed, and their contents coalesce. It frequently happens that parts of old sclerotia are incapable of resuscitation, but they afford a pabulum for the newly awakened plasmodium, through whose veins the cysts may be seen to be carried along and broken up. The sclerotium of Didymium effusum is sprinkled over with a deposit of crystals of lime, and after being revived the cyst-walls are not dissolved, as in Baddamia, but remain as empty hyaline sacs when the contents has crept out. The formation of sclerotia in plasmodia inhabiting the interior of rotten wood is less easy to follow, but it is probably of frequent occurrence. A plasmodium of Smonitis fusca, cultivated from spores in a moist chamber, passed into the resting state a few days after it had formed, spreading in a single layer of crowded cysts on the surface of the glass. This sclerotium was dried and re-wetted, when it revived, and the cyst-walls were dissolved; the cultivation was conducted with pure water, with no attempt to supply nourishment, and the plasmodium returned to the encysted condition in about twenty-four hours; it was again dried and again revived, but afterwards it reassumed the sclerotium state, from which it could not be reawakened.

The Sporangium and Sporophore. — The formation of the sporangium in the Endosporae has been minutely described by de Bary,† and only a brief notice of the general characters will be sufficient here. The plasmodium concentrates at certain points and develops into sporangia of the various forms which will be found described in the account of each species; they are either simple, though often densely clustered, or they are combined into an ethalium, a cushion-like structure consisting of numerous convoluted or imperfectly-defined sporangia. The simple forms are either symmetrical, with or without a stalk, or they are unsymmetrical, spreading on the substratum with an irregular outline, when they are called plasmodiocarps. In most cases the shape of the sporangium is nearly constant, while in others it is subject to much variation. Two abundant species, Physarum nutans and Didymium effusum, may be mentioned as examples of variable habit; in each of them we often find vein-like plasmodiocarps and symmetrical sporangia both stalked and sessile, resulting from the same plasmodium. It is true of the shape of the sporangium, as it is of the size of the spores and the form and colour of the capillitium, that though a valuable guide, it cannot be taken as supplying a rigid specific character; and the want of a sufficient series of specimens showing how widely a species may vary, has led to the multiplication of names without adequate grounds.

† De Bary, l.c., p. 424.
In examining the rising sporangia of *Physarum nutans* in a moist chamber under the microscope, the projecting masses of plasmodium are seen to pulsate, distending and shrinking as the rhythmic flow advances or retreats, but gradually gaining with the advancing movement. The basal part of each contracts and forms a stalk consisting of a tube of tougher hyaline substance through which the protoplasm continues to pass until the surrounding veins have emptied their contents into the spherical sporangium. The coarse refuse matter which has not been discharged along the track of the plasmodium, where it often takes the form of a hypothallus connecting the sporangia, is deposited in the centre of the stalk. When the young sporangium has attained its full dimensions, the wall thickens, and a part of the lime granules which abounded in the plasmodium is incorporated in the wall-substance; the remaining part is collected into the *lime-knots* or vesicular swellings of the hyaline threads of the capillitium; these threads branch and anastomose, forming a network which spreads through the spore-plasm from the base of the sporangium to its wall. The formation of spores takes place after the capillitium has been developed in all the genera which are characterised by its presence. In *Didymium* the lime-granules which can be seen in the plasmodium are dissolved in the sporangium, and the salt in solution passes through the soft sporangium-wall and forms into crystals on the outer surface. The various kinds of capillitium represented in the different genera and species are described in the text. The formation of spores in the *Endosporaceae* is preceded by the division of the nuclei in the spore-plasm by karyokinesis. The process was first recorded by Strasburger as occurring in *Trichia fallax*. Recent observations show that this mode of nuclear division takes place in the sporangium only once, and occurs almost simultaneously in all the nuclei rather more than an hour before the spores begin to be

*Botanische Zeitung, May 1884.*
formed. The chromatin constituents of the nucleus first show a
coarser arrangement, which is followed by the "spindle stage,"
exhibiting an equatorial plate with achromatic fibres converging
at the poles. In Badhamia, Physarum, Craterium, Didymium,
Stemonitis, Lamproderma, and Comatricha the plasma at this
period breaks up into lobed masses containing six to ten nuclei;
the equatorial plate of each nuclear spindle now divides horizontally,
and as the two halves draw apart the lobed masses of plasma
undergo a further division, until the time when the daughter-
nuclei have widely separated. Though still connected by achro-
matic fibres, each pair is enclosed in a portion of plasma of the
capacity of two spores; these portions become constricted into
the ultimate spores, each containing a single nucleus: in a short
time the spore wall is acquired, and the active stage of the
organism comes to a close. In the genera just mentioned, spore-
formation occurs in warm weather about twenty hours after
the sporangia have taken

* In Trichia the in-
terval is much longer, ex-
tending from two to four
days according to the tem-
perature. In this genus and
also in Arelyria, Lycogala,
and Reticularia Lycoperdon,
the spore-plasm is not seen
to separate in lobed masses
at the time when the nuclear spindle is formed,
but the karyokinetic pro-
cess is completed and the
daughter - nuclei are de-
initely parted from one
another before the plasma
breaks up and encloses each
nucleus in a young spore.*

The sporophores of Ceratiomyxa are columnar, or confluent and
interlacing. In their early stage the protoplasmic matter spreads
throughout the superficial part of the columns, and also in
numerous veins traversing the watery gelatinous interior sub-
stance. These veins are ultimately withdrawn to the outer layer,
which divides into polyhedral portions of equal size, giving an
areolated structure to the even periphery; each portion contains
a single nucleus 2-5 μ in diameter. The whole sporophore is
invested by a thin hyaline layer. The material of this investing
layer and the interior gelatinous substance take a bright red
colour in preparations stained in picrocarmine, which contrasts
with the yellow tint of the protoplasmic matter. The contents of

* Nuclear division is observed by taking stainings, at short intervals, of
the contents of groups of sporangia which have risen together at one time;
further details are given in Linn. Soc. Journ., vol. xxix., p. 529.
INTRODUCTION.

Each areola now rises in a shortly cylindrical projection from the surface of the sporophore, carrying with it a hyaline investment, which becomes constricted at the base of the cylindrical process. This constriction is continued until an elongated membranous stalk is formed, bearing at its apex a globule containing the protoplasmic matter with its nucleus. The contents of the globule develops in the course of a few hours into the ellipsoid spore; this is enclosed in a membranous wall, and is easily detached from the stalk. The gelatinous sporophore dries to a membrane of the frailest structure, and disappears with the first shower of rain. The process by which the eight swarm-cells derive their nuclei from the single nucleus of the areolar space of the sporophore has not been followed; but, judging from analogy, we conclude that a succession of divisions took place from the original nucleus. It appears uncertain how far the changes met with in the sporophores of Ceratiomyxa have an exact parallel in what is seen in the development of the sporangia of the Endosporeceae. Taking the sporophore as representing the sporangium, we have in both cases a structure developing from the plasmodium and consisting of supporting elements and spore-plasm. In all the Endosporeaceae, so far as has been observed, the nuclei divide by karyokinesis shortly before the spores are formed, and this division is accompanied in many instances, as before mentioned, by the lobing of spore-plasm into masses of two spores' capacity round the dividing nucleus. If the stalked bodies formed on the surface of the sporophore correspond with the spores of the Endosporeaceae, we should expect a previous karyokinetic division of nuclei to have taken place; a process which has hitherto, however, escaped detection in stained preparations. We should then view the division of the spore-contents of Ceratiomyxa into eight swarm-cells, as corresponding with a series of multiplications of a swarm-cell of the Endosporeaceae with arrested cell-division. But the whole process requires further careful investigation, and, with the facts already in our possession, there are two other hypotheses which may be suggested as possible. The areole of the sporophore may represent the masses of two spores' capacity present round the dividing nucleus in many of the Endosporeaceae; but in this case the masses become encysted and stalked, nuclear division is deferred until the cysts are fully formed, and it is not until these have been placed in water that the cyst-wall is thrown off and the contents divided into eight naked spores. A third and widely different view takes what have commonly been regarded as equivalent to spores in Ceratiomyxa as representing stalked sporangia, arising in great numbers and regularity from the surface of the gelatinous body, which corresponds to a branched and complex hypothallus. Each sporangium, which at first contains a single nucleus, on being placed in water throws off its sporangium-wall and divides into eight naked spores.

Should either of the two latter views prove to be the true one, the definition of the Mycetozoea would require to be modified, for the rhythmic streaming of its plasmodium and the character of its...
swarm-cells show that *Ceratiumyxa* belongs in essential points to the *Mycetozoa*, but with modifications in the intermediate stages of development.

As has been stated before, many species of the *Mycetozoa* are associated with numerous varieties, using the word *species* as a name given for the convenience of classification to a form possessing definite and permanent characters which distinctly separate it from any other; and the word *variety* to such as are linked with the type by a close series of connecting forms, and although more or less stable, do not possess such distinctive characters as would render it expedient or helpful to mark them with specific rank.

The geographical distribution of most of the species is very wide, and the main characters are remarkably constant in specimens gathered in all parts of the world.

Specimens of *Hemitrichia clavata*, *H. Serpula*, *Dictyidium umbilicatum*, and *Trichia fallax*, obtained from Europe, India, and North and South America, are identical to the most minute microscopic detail; and numerous other equally stable forms might be cited. On the other hand, the American and tropical species of the genus *Cribraria* are more elegant in form than individuals of the same species here and on the Continent, and most of them show a tendency, in the great regularity of their structure, towards the type of *C. intricata*, a striking and well-marked species which is abundant in those regions, but rare in our less brilliant atmosphere. The genus is largely represented in America, and intermediate forms between the recognised species are frequent; some of these are described by Dr. Rex in letters to me as being constant in gatherings from several States, but they are so closely allied to established types that he hesitates to give them separate specific names. The more elegant growth in the American species is not confined to the genus *Cribraria*, but is of general occurrence; and it is probable that the slight modification of the prevailing type is due to the influence of climate. This is what might be looked for when we consider the effects which changes of weather produce in the development of sporangia in this country. On old decaying stumps which can be kept under observation for several years, we may have growths of *Trichia affinis*, which year after year present the same typical characters, only differing in the elaters in one season being slightly thicker than those in another. When cold weather sets in while the plasmodium is rising, the arrangement of the spiral bands is so abnormal as to suggest a marked variety, but with a return of milder weather the original form reappears, leaving no doubt that all have been derived from a common parentage. Developments of *Trichia persimilis* of the typical form have been followed after a few nights' frost by a growth in which the short and nearly smooth elaters closely resemble those of *Oligonema nitens*, though the spores and the shape of the sporangia retain the normal character. *T. scabra*
may exhibit a *Hemitrichia*-like capillitium; and a specimen of *Hemitrichia Serpula* from New Zealand, which has the appearance of having been affected by weather at the time of development, has a part of the capillitium consisting of short fusiform elaters. In some extensive gatherings of *Trichia affinis* which have matured in hot, dry weather, the elaters are so reduced in size as scarcely to exceed the diameter of a spore in length, though the sporangia are perfectly normal in form, and the spores are marked with the typical sculpture. In *Stemonitis, Lamproderma, Prototrichia*, and other genera, great variations are caused by changes of temperature; but in none of these cases which have come under my observation is there any indication of a transition from one species to another. An interesting account is given by Dr. Rex of a remarkable and abnormal development of *Stemonitis splendens*, referred to under the description of that species in this work, where, through successive generations, a gradual return took place to the normal type. In this instance other causes than change of temperature must have taken part.

Although the search for specimens of the Mycetozoa has been comparatively limited, owing, no doubt, to the small size of the objects, yet in consequence of the persistent nature of the sporangia, we possess, in the different herbaria, specimens representing the gatherings from many countries during more than half a century, and some of them dating back to nearly a hundred years. Where they have escaped rough treatment, they completely retain their specific characters. In reviewing these specimens one is struck with the completeness of the group and the general stability of the species; and when we consider their cosmopolitan distribution, owing, we may conclude, to the long-continued vitality and minuteness of the spores, it may be doubted whether any hitherto unsearched region will add very largely to the number of species with which we are already acquainted. It is their life history which is at present imperfectly known, and it is in this direction that the important work of the future must lie.

The affinities of the *Mycetozoa* have been dealt with by de Bary and Zopf in the works before referred to.

It had been suggested that they were allied to the fungi through the *Chytridaceae*, which do not always form a mycelium, and in which the entire vegetative body is finally transformed into a many-spored sporangium, the vegetative body and spores having the power of ameboid movement for a longer or shorter time. De Bary, however, mentions among other points of difference that the *Chytridaceae* do not form a plasmodium by the coalescence of swarm-cells, "and there is therefore no ground for assuming their direct relationship with the Mycetozoa." *

The position of the *Acrasieae* in which the swarm-cells exhibit

* De Bary, l.c., p. 445.
amœboid movements, but do not produce a flagellum, and aggregate without coalescing into a true plasmodium, has already been referred to (p. 1). The view held by de Bary that the Mycetozoa are more closely associated with the Protozoa is supported by a comparison with the pelagic Protomyxa of Haeckel, which is stated to develop a plasmodium by the coalescence of swarm-spores, and differs from the Mycetozoa chiefly in the absence of a firm spore membrane;* also by comparison with Bursulla, which, according to Sorokin, forms a true plasmodium and minute sporangia on horse dung; the spores do not become invested with a firm membrane, and escape from the swollen apex of the sporangium in the form of swarm-cells, without cilia, but capable of amœboid movement."† Zopf extends the Mycetozoa so as to embrace the Monadinea of Cienkowski, but de Bary maintains that whatever may be the points of agreement between the Monadinea and the Mycetozoa they are not such as to warrant their being classed with the latter division as defined by himself.‡ Lankester accepts the group as defined by de Bary, and places them in his grade Gymnomycxa of Protozoa; he suggests their affinity with the Sporozoa.§

The ingestion of bacteria by the swarm-cells appears to strengthen the view that the group is more nearly associated with the lower forms of animal than of vegetable life, and the name of Mycetozoa appears to mark its true position in the borderland between the two kingdoms. For a more complete discussion of this subject I must refer to those who have paid special attention to the allied groups.

In preparing this catalogue of the collection of Mycetozoa in the British Museum, the arrangement of orders and genera given by Rostafinski in his Monograph‖ has been mainly followed, with such alterations as observations made during recent years have rendered necessary. De Bary made the group the subject of minute and thorough investigation;¶ and Rostafinski, while studying under him at Strassburg, devised a system of classification which is clear and comprehensive, and is now generally accepted.

The division by Rostafinski of the main section Endosporace into two parts, distinguished by the colour of the spores, has been objected to as being artificial and wanting in universal application, but the cases in which species offer difficulty with regard to their position under this scheme are few, and on the whole the organisms range themselves under the separate heads in a remarkably natural manner, while for determining the species the plan is simple and convenient.

* De Bary, l.c., p. 449.
† Ibid., p. 446.
‡ Ibid., p. 443.
§ Zoological Articles, 1891, pp. 11, 26.
‖ Sluzowce (Mycetozoa) Monographia (Paris: 1875).
¶ Comp. Morph. and Biol. Fungi, Mycetozoa, etc., p. 421.
In this catalogue the descriptions of the different species given in the text are taken from specimens I have personally examined; a list is appended at the end of each genus of such as are not represented in the collections to which I have had access, and in these cases the definitions are copied from the books in which they are described. I am far from supposing that my work is free from inaccuracy, but every species of which I have given the characters can be examined, either in bulk or as a mounted object, in the British Museum collection. The specimens I have supplied to supplement the collection are indicated in the following pages under each species by the letters L:B:M.

The rules which govern the nomenclature of species, laid down by Alph. de Candolle, "Laws of Botanical Nomenclature" (1868), and adopted by botanists, require that the first authentic specific name published under the genus in which the species now stands shall take precedence of all others. Compliance with this direction has occasioned considerable alteration of the names given in Rostafinski's Monograph, in which work a severe attention to this important principle has not been observed. I am greatly indebted to Mr. Carruthers, who, in addition to other valuable assistance, has traced the history of each species in the volumes of the British Museum Library, and made the necessary corrections.

I offer my grateful acknowledgments to those through whose courtesy I have been enabled to study the various herbarium specimens that have come under my notice; to the Director of the Royal Gardens at Kew for giving me special facilities for investigating the collection under his care, which includes Berkeley's precious series, containing a great number of original types from India, New Zealand, and America that supplied Rostafinski with a large part of the material introduced into the Appendix to his Monograph. These types are to a large extent duplicated in Broome's and Ravenel's collections in the British Museum. To Professor Bayley Balfour I return my thanks for much friendly assistance and for the opportunity of inspecting the specimens in the Royal Herbarium at Edinburgh, including Greville's collection and an almost complete set of type examples supplied by the late Professor de Bary; to Professor van Tieghem for the inspection of the collection of the Paris Museum; to Professor A. Blytt for an opportunity of examining the most important types in the Museum at Christiania; to Dr. Boerlage for giving me access to the Leyden collections; and especially to Graf zu Solms-Laubach for the privilege afforded me of inspecting de Bary's invaluable collection at Strassburg, containing a large proportion of the type specimens referred to by Rostafinski in his original Monograph; to Dr. Rex, of Philadelphia, for a nearly complete series of the species found in the United States of America, now represented in the British Museum collection, and for the communication of his views on a group to which he has devoted many years of careful research. I am also grateful to my friend Professor Farlow for many valuable speci-
mens and useful suggestions; and to Professor Macbride, of Iowa, and Mr. Morgan, of Ohio, for a fine series of the Mycetozoa from their respective districts; also to Dr. Haviland for specimens of great interest from Borneo. Mr. Camm, of Smethwick, and Mr. Saunders, of Luton, have supplied me with many scarce British species; and to Mr. Phillips and Mr. Massee I am obliged for kindly entrusting me with their collections for examination.

The Plates in this work are collotype reproductions of water-colour drawings made under the camera-lucida and reduced to half the originals; the descriptions of the spore sculpture in the text must therefore be understood as giving the appearance when magnified 1200 diam., Zeiss $\frac{1}{15}$th obj.

I have further to mention that throughout my studies of the Mycetozoa, and in the preparation of the drawings illustrating this work, I have had the assistance of my daughter, Gulielma Lister.
SYNOPSIS OF THE ORDERS AND LIST OF THE GENERA OF THE MYCETOZOA.

Subclass 1.—EXOSPOREÆ. Spores developed outside the sporophores. (P. 25.)

Order I. — CERATIOMYXACEÆ. Sporophores membranous, branched; spores white, borne singly on filiform stalks arising from the areolated sporophore (P. 25.)

Genus 1. Ceratiomyxa Schroeter. (P. 25.)

Subclass II.—ENDOSPOREÆ. Spores developed inside the sporangium. (P. 26.)

Cohort I.—AMAurosporales. Spores violet, or violet-brown, except in Stemonitis and Comatricha, in a few species of which they are pale ferruginous. (P. 26.)

Subcohort I.—CALCARINEÆ. Sporangia provided with lime (calcium carbonate). (P. 26.)

Order I.—PHYSARACEÆ. Lime in minute innate granules. (P. 26.)

Genus 2. Badhamia Berk. (P. 29.)
3. Physarum Pers. (P. 37.)
4. Fuligo Haller. (P. 65.)
5. Cienkowskia Rost. (P. 68.)
6. Physarella Peck. (P. 68.)
7. Craterium Trent. (P. 69.)
8. Leocarpus Link. (P. 75.)
9. Chondrioderma Rost. (P. 75.)
10. Trichamphora Jungh. (P. 89.)
11. Diachaea Fries. (P. 90.)

Order II.—Didymiaceæ. Lime in crystals. (P. 93.)

Genus 12. Didymium Schrad. (P. 93.)
13. Spumaria Pers. (P. 104.)
14. Lepidoderma de Bary. (P. 105.)

Subcohort II.—AMAurochætineæ. Sporangia without lime. (P. 108.)

Order I.—Stemonitaceæ. Sporangia simple. (P. 108.)

Genus 15. Stemonitis Gled. (P. 109.)
16. Comatricha Preuss. (P. 116.)
17. Enerthenema Bowm. (P. 124.)
18. Lamproderma Rost. (P. 125.)
19. Clastoderma Blytt. (P. 132.)
Order II.—*Amaurochætaceæ*. Sporangia combined into an æthalium. (P. 134.)

Genus 20. *Amaurochæte* Rost. (P. 134.)
21. *Brefeldia* Rost. (P. 135.)

Cohort II.—*Lamprosporales*. Spores variously coloured, never violet. (P. 136.)

Subcohort I.—*Anemineæ*. Capillitium wanting, or not forming a system of uniform threads. (P. 136.)

Order I.—*Heterodermaceæ*. Sporangium-wall membranous, beset with microscopic, round granules, and (except in *Lindbladia*) forming a net in the upper part. (P. 136.)

Genus 22. *Lindbladia* Fries. (P. 137.)
23. *Cibraria* Pers. (P. 138.)
24. *Dictydium* Schrad. (P. 148.)

Order II.—*Liceaceæ*. Sporangium-wall cartilaginous; sporangia solitary. (P. 149.)

Genus 25. *Licea* Schrad. (P. 150.)
26. *Orcadella* Wing. (P. 152.)

Order III.—*Tubulinaceæ*. Sporangium-wall membranous, without granular deposits; sporangia tubular, compacted. (P. 152.)

Genus 27. *Tubulina* Pers. (P. 153.)
28. *Siphoptychium* Rost. (P. 155.)
29. *Alwisia* Berk. & Br. (P. 155.)

Order IV.—*Reticulariaceæ*. Sporangia combined into an æthalium, the sporangium-wall incomplete, perforated or forming a spurious capillitium. (P. 156.)

Genus 30. *Dictydiæthalium* Rost. (P. 157.)
31. *Enteridium* Ehrenb. (P. 158.)
32. *Reticularia* Bull. (P. 160.)

Subcohort II.—*Calonemineæ*. Capillitium present, a system of uniform threads. (P. 161.)

Order I.—*Trichiaceæ*. Capillitium consisting of free elaters, or combined into an elastic network with thickenings in the form of spirals or complete rings. (P. 161.)

Genus 33. *Trichia* Haller. (P. 163.)
34. *Oligonema* Rost. (P. 173.)
35. *Hemitrichia* Rost. (P. 174.)
36. *Cornuvia* Rost. (P. 181.)

Order II.—*Arcyriaceæ*. Capillitium combined into an elastic network with thickenings in the form of cogs, half rings, spines,
or warts (scanty and often reduced to free threads in *Perichæna corticalis*). (P. 182.)

Genus 37. *Arcyria* Hill. (P. 183.)
38. *Lachnobolus* Fries. (P. 194.)

Order III.—Margaritaceæ. Capillitium not consisting of free elaters, nor combined into an elastic network. (P. 202.)

Genus 40. *Margarita* Lister. (P. 202.)
41. *Dianema* Rex. (P. 204.)
42. *Prototrichia* Rost. (P. 206.)

Order IV.—Lycogalaceæ. Sporangia forming an æthalium, capillitium consisting of smooth or wrinkled branching colourless tubes. (P. 207.)

Genus 43. *Lycogala* Mich. (P. 207.)
MYCETOZOA de Bary.

Subclass I.—EXOSPOREÆ. Spores developed outside the sporophores.

Order I. — CERATIOMYXACEÆ. Sporophores membranous, branched; spores white, borne singly on filiform stalks rising from the areolated sporophore.

Genus 1.—CERATIOMYXA Schroeter, in Engl. and Prantl, Nat. Pflanzenfam., i., 1, p. 16 (1889). Sporophores consisting of membranous processes, either simple branches from a common base, or forked, or forming a network. The periphery is mapped out into polyhedral areolae, from the centre of each of which arises a slender stalk bearing a single ellipsoid colourless spore.—Ceratium Alb. & Schw., Cons. a. Fung., p. 358 (1805) non Schrank (1793).

Fig. 9.—Ceratiumyx mucida Schroet.
b. Sporophore. Magnified 40 times.
c. Four areolae of mature sporophore: one spore still attached to its stalk, and another free. Magnified 480 times.

The sporophores are subject to much variation in form, and may all be either white or pinkish-yellow.

a. genuina: branches of sporophores short, free.

β. flexuosa: sporophores consisting of a loose flexuose system of slender white threads, profusely branching but not anastomosing, and averaging about 0.02 mm. in diameter, increasing to 0.5 mm. at the base, the ultimate branchlets somewhat clavate. In other characters this corresponds with the type.—*Ceratium filiforme* Berk. & Br., in Journ. Linn. Soc., xiv., p. 97.

γ. porioides: differs from the type only in the dense arrangement of the sporophores. As intermediate forms occur which unite it with the type, I cannot consider it specifically distinct. Superficially it suggests the appearance of *Polyporus vulgaris*, though much more minute.—*Ceratium porioides* Alb. & Schw., ConsP. Fung., p. 359; Fr., Syst. Myc., iii., p. 295; Fam. & Wor., in Mem. Acad. Imp. Petersb., Ser. 7, xx., p. 5; Zopf, Pilzthiere, pp. 64, 174.

Plate I., A.—Fig. a. var. genuina: sporophores, x 20 (England); b. spores of the same, x 600; c. sporophores of a form approaching var. porioides, x 20 (England); d. var. flexuosa: sporophores, x 20 (Borneo); e. clavate end of sporophore of the same (all the spores but one have fallen from their stalks), x 280.


Subclass II.—ENDOSPOREA. Spores developed within the sporangia.

Cohort I.—AMAUROSPORALES. Capillitium always present. Spores violet or violet-brown, but pale ferruginous in a few species of *Stemonitis* and *Comatricha*.

Subcohort I.—CALCARINEAE. Deposits of lime in minute granules, innate in the sporangium-wall or compacted in the knots of the capillitium or in the stalk, or in crystals over the sporangium-wall.

Order I.—PHYSARACEAE. Deposits of lime in minute granules, more or less aggregated, not in crystals (except partially in *Chondrioderma Trevelyani*), innate in the sporangium-wall, and in vesicular expansions of the capillitium (= lime knots), except in *Chondrioderma* and *Trichamphora*, where there are no lime knots, and in *Diachaea*, in which the lime is confined to the stalk and columella. Sporangia simple except in *Fuligo*, where they are combined into an æthalium.
KEY TO THE GENERA OF PHYSARACEÆ.

_A._ Capillitium a coarse network charged with lime throughout.

(2) _Badhamia._

Fig. 10.—_Badhamia utricularis_ Berk.

_a._ Cluster of sporangia. Magnified 3½ times.

_b._ Fragment of capillitium and spore-cluster. Magnified 140 times.

_B._ Capillitium a delicate network of threads with vesicular expansions filled with lime-granules (= lime-knots).

_A._ Sporangia combined into a convolute æthalium.

(4) _Fuligo._

Fig. 11.—_Fuligo septica_ Gmel.

_a._ Æthalium. One-third natural size.

_b._ Capillitium threads with lime-knots and two spores. Magnified 120 times.

b. Sporangia single, scattered or aggregated.

_a._ Sporangium-wall membranous, with innate lime-granules either in clusters or compacted and chalky. Sporangia subglobose or plasmodiocarps.

(3) _Physarum._

Fig. 12.—_Physarum nutans_ Pers.

_a._ Two sporangia. Magnified 9 times.

_b._ Capillitium threads, with lime-knots, attached to a fragment of the sporangium-wall. Magnified 110 times.
Sporangia tubular, stalked.  

(6) Physarella.

Fig. 13.—Physarella mirabilis Peck.
Two sporangia, one perfect, the other dehiscing in revolute lobes from the funnel-shaped columella. Magnified $6\frac{1}{2}$ times.

b. Sporangium-wall cartilaginous throughout or at the base.
Sporangia plasmodiocarps, capillitium with free hooked branches.  

(5) Cienkowskia.

Fig. 14.—Cienkowskia reticulata Rost.

a. Part of branching plasmodiocarp. Magnified 4 times.
b. Capillitium threads and part of a perforated lime-plate. Magnified 140 times.

Sporangia goblet-shaped with a lid of thinner substance, or subglobose and rugose.  

(7) Craterium.

Fig. 15.—Craterium vulgare Ditm.

a. Two sporangia; in one the lid has fallen away. Magnified 10 times.
b. Capillitium with lime-knots and two spores. Magnified 110 times.

Sporangia ovoid, shining as if varnished.  

(8) Leocarpus.

Fig. 16.—Leocarpus vernicosus Link.
a. Cluster of sporangia. Magnified $2\frac{1}{2}$ times.
b. Hyaline threads and branching lime-knot of the capillitium, with two spores. Magnified 120 times.
C. Capillitium without lime-knots.

Sporangium-wall of two layers more or less combined.

(9) *Chondrioderma.*

Fig. 17.—*Chondrioderma testaceum* Rost.

a. Group of three sporangia; in the upper one the double wall is broken away in part and the columella exposed. Magnified 9 times.

b. Portion of the outer and inner layers of the sporangium-wall; to the latter the capillitium threads are attached: three spores. Magnified 170 times.

Sporangium-wall of one layer, fragile; sporangia saucer-shaped.

(10) *Trichamphora.*

Fig. 18.—*Trichamphora pezizoidea* Jungh.

a. Group of sporangia. Magnified 5½ times.

b. Capillitium with two spores. Magnified 140 times.

D. Lime confined to the stalk and columella, sporangium-wall membranous.

(11) *Diachlea.*

Fig. 19.—*Diachlea elegans* Fries.

Two sporangia, the one entire, the other deprived of the spores and showing capillitium and columella. Magnified 22 times.

Genus 2.—**Badhamia** Berkeley, in Trans. Linn. Soc., xxi., p.153 (1852). Sporangia stalked, sessile, or plasmodiCARPS; sporangium-wall single, with innate lime-granules sparsely distributed, densely clustered, or forming a thick deposit; columella present or wanting; capillitium consisting of a coarse network charged with granules of lime (in *B. panicea, B. decipiens*, and *B. nitens* sometimes constricted here and there into narrow hyaline threads); spores clustered or free, warded, reticulated, or nearly smooth.
KEY TO THE SPECIES OF BADHAMIA.

A. Spores clustered:—
   a. Spores warted on one side chiefly—
      Lime in sporangium and capillitium white.  
      Lime in sporangium and capillitium yellow.

   1. B. hyalina
   3. B. nitens

   b. Spores warted equally all over.  
      2. B. utricularis

B. Spores not clustered:—
   a. Sporangia yellow or orange.  
      4. B. decipiens

   b. Sporangia white or grey—
      Sporangia on long membranous stalks, spores nearly  
      smooth, black.  
      Sporangia sessile or with firm stalks, spores minutely  
      and closely spinulose, dark, purple-brown.

   5. B. magna
   6. B. macrocarpa
   7. B. panicea

   c. Sporangia flesh-coloured or rufous—
      Sporangia sessile, without a true columella.  
      Sporangia stalked; stalk continued into the spor-  
      angium as a columella.

   8. B. lilacina
   9. B. rubiginosa

   Plasmodium chrome-yellow. Sporangia globose or pyriform, sessile  
   or stipitate, 0·7 to 1·5 mm. diam., greyish-white, pure white after  
   dispersion of the spores; sporangium-wall hyaline, with lime-  
   granules sparsely distributed. Stalk usually short or wanting,  
   cylindrical or membranous, straw-coloured or dark. Capillitium  
   a network of flat bands with broad, thin expansions at the angles;  
   lime-granules evenly but not densely distributed throughout.  
   Spores dark purple-brown, adhering in clusters of 8 to 20, coarsely  
   warted on the outer third, minutely spinulose on the rest of the  
   surface, 11 to 13 μ diam.—Rost., Mon., p. 139, fig. 113; Cooke,  
   Physarum hyalinum Pers., in Römer, N. Mag. Bot., i., p. 88  

   a. genuina: stalk pale, membranous, or almost wanting; spores  
   in clusters of 10 to 20.

B. papaveracea: stalk short, dark; spores in dense clusters  
   of 6 to 10.—Badhamia papaveracea Berk. & Rav., in Grev., ii.,  
   p. 66; Rost., Mon., App., p. 3; Mass., Mon., p. 323 (in part).
Plate I. B.—a. and b. var. genuina; sporangia, × 20 (England); c. capillitium; d. cluster of spores of the same, × 280. e. spore, warted on the outer side, × 600; f. spore almost uniformly spinulose, × 600; g. var. papaveracea; sporangium, × 20 (New Jersey). h. cluster of spores of the same, × 280.

This species forms small plasmodia; it is subject to much variation in the size of the sporangia and in the character of the stalk and spores. In some gatherings the spores are fuliginous and not so dark as the type, loosely adhering and scarcely rougher on one side, not exceeding 10 to 11 μ diam.; all intermediate forms occur. B. papaveracea Berk. & Rav. is an American form differing from the European chiefly in the stalk being usually dark, rigid, even, and filled with refuse matter, and in the spores being in clusters of seldom more than 6 to 10; these characters are not constant, as is shown in specimens B. M. 996, and do not appear to constitute a specific distinction. B. capsulifera Berk. is described as having the sporangia somewhat obovate, and the type at Strassburg, referred to in Rostafinski’s Monograph, has this form, but the spores are in large clusters, warted on the outer surface, like those of B. hyalina; we not infrequently meet with both globose and pyriform sporangium intermixed; the shape of the sporangium therefore cannot be accepted as distinctive, and B. capsulifera must be included under B. hyalina.

Hab. On fir logs, etc., the plasmodium growing in the substance of the logs and spreading between the bark and wood.—a. Batheaston, Somerset (B. M. 36); Bristol (B. M. 79); Leighton, Beds. (L:B.M.2); Luton, Beds. (L:B.M.2); Lyme Regis, Dorset (L:B.M.2); France (Paris Herb.); Germany (Strassb. Herb.). β. Pennsylvania (B. M. 996β); S. Carolina (B. M. 996α); Massachusetts (L:B.M.2).


Plate II. A.—a. cluster of sporangia, × 20 (England); b. capillitium, × 280; c. cluster of spores, × 280; d. spore, × 600.

This species differs from B. hyalina in habitat, in having large plasmodia commonly producing some thousands of sporangia, and in the spores being brighter in colour, with coarser and less crowded spines, without the cluster of warts on one side. In cultures carried on continuously for more than six years, the four varieties described in Rostafinski’s Monograph have presented themselves. The capillitium varied both in form and in the amount of lime it contained; in some the threads were broad with wide expansions at the angles, in others they were narrow and but little widened at the angles; in some the lime was abundant, in others only a few scattered granules could be found. The agglutination of the spores was seen to vary in different
growths, though all were cultivated from one original gathering of
plasmodium, but they were never free as in B. macrocarpa. In some
specimens in the Strassburg collection the spores show but slight
indication of clustering, in others this character is well marked.

Hab. Plasmodium extensively creeping over the bark of fallen trees,
logs, etc., feeding on effused fungi, especially Stereum hirsutum and
Polyporus versicolor.—Batheaston, Somerset (B. M. 103); Lyme Regis,
Dorset (L:B.M.3); Glamis, Forfarshire (B. M. 149); France (Paris
Herb.); Germany (Strassb. Herb.); Italy (K. 165); Massachusetts
(L:B.M.3).

Plasmodium yellow. Sporangia sessile, subglobose, gregarious or
clustered, or elongated plasmodiocarps about 1 mm. diam.; golden
yellow, rugose, or greenish with yellow warts and ridges; sporangium-wall
membranous with innate clusters of yellow
lime- granules. Columella none. Capillitium yellow or orange, a
course network of rugged bands, rarely contracted to form short
hyaline threads connecting branched lime-knots; deposits of lime
usually dense, sometimes sparse. Spores purple-brown, in close
clusters of 6 to 10, minutely spinulose, coarsely warded on the
outer third, sometimes nearly free and scarcely warded on one
side, 10 to 13 μ diam.—Rost., Mon., App., p. 3; Cooke, Myx. Brit.,

Plate III, A.—a. group of sporangia, × 20; b. capillitium with attach-
ments to the sporangium-wall, × 280; c. cluster of spores, × 280; d.
spore, × 600.

Examination of the type specimens of B. nitens and B. pallida of
Berkeley, from the Rev. C. Badham (Kew 1218, 1235), and of B.
inaurata Currey (B. M. 151), shows that they are all the same species
with yellow sporangium-wall and closely clustered spores coarsely
warded on one side.

Hab. In the substance of rotten wood, creeping on moss, etc.
Hitherto found only in England.—Lyme Regis, Dorset (L:B.M.4);
Luton, Beds. (L:B.M.4); East Bergholt, Essex (K. 1235, 1241); Cray
Common, Kent (B. M. 151).

Sporangia branching or vermiciform plasmodiocarps, occasionally
subglobose, 0·3 to 0·4 mm. diam., sessile, gregarious, rugose
or nearly smooth, lemon-yellow or orange; sporangium-wall
membranous with innate clusters of yellow lime-granules.
Columella none. Capillitium yellow or pale orange, a coarse
network densely charged throughout with lime-granules, or
formed of large angular and branching lime-knots with few
connecting hyaline threads. Spores violet-brown, spinulose,
10 to 13 μ diam.—Physarum decipiens Curt., in Am. Journ. Sc.,
Didymium reticulatum Berk. & Br., in Herb. Berk. Lepidoderma

Plate III., B.—a. plasmodiocarp, \( \times 20 \) (New York); b. capillitium, \( \times 280 \); c. spore of the same, \( \times 600 \); d. plasmodiocarps, \( \times 20 \) (S. Carolina: type of Curtis in Strassb. Herb.); e. capillitium, \( \times 280 \); f. spores of the same, \( \times 600 \); g. plasmodiocarp, \( \times 20 \) (Poland: type of B. Alexandrowiczii Rost. in Strassb. Herb.); h. capillitium, \( \times 280 \); i. spore of the same, \( \times 600 \).

An authentic specimen from Curtis (B. M. 994) has too little left for identification, yet some spores and a fragment of sporangium which were scraped off were identical with a good typical specimen in Strassb. Herb., sent by Prof. Farlow from Curtis's original gathering.

In the type specimens of both Budhamia Alexandrowiczii Rost. and Didymium reticulatum Berk. & Br. (B. M. 574), the sporangia are slender, rugose, yellow plasmodiocarps, having Budhamia-like capillitium with few hyaline threads, the spores 10 to 12 \( \mu \) diam.; they closely resemble the common North American form which appears in the Schweinitzian collection under the name of Cienkowskia reticulata Rost. In these American specimens the capillitium has large, branching, pale-yellow lime-knots sparingly connected by hyaline threads. Spores 9 to 11 \( \mu \) diam. Budhamia chrysostricha Rost. differs from the last only in the more completely Budhamia-like capillitium and the rather larger spores, measuring 11 to 13 \( \mu \).

Hab. The original specimen was found on the trunk of a living oak. It is found also on dead wood, moss, etc.—Poland (Strassb. Herb. and L:B.M.5 slade); Ceylon (B. M. 574); Pennsylvania (L:B.M.5); S. Carolina (B. M. 994).


Plate II., B.—a. sporangia, \( \times 20 \) (Vermont: Peck's type); b. spores, \( \times 600 \).

This species has been recorded only from America, and is represented in the collection by a mounting from Peck's type; it is nearly allied to B. hyalina Berk.

Hab. On dead wood.—Philadelphia (L:B.M.6).

6. B. macrocarpa Rost., Mon., p. 143, figs. 118, 120, 121 (1875). Plasmodium? Sporangia sessile, subglobose, aggregated, or stipitate, gregarious, 0·5 to 1 mm. diam., white, rugose; sporangium-wall membranous, varying in the amount of innate lime-deposits. Stalk when present erect, about 0·7 mm. long, 0·1 mm. diam., thicker above and below, furrowed, yellowish-

Plate IV., A.—a. stalked sporangia, × 20 (Berlin); b. sessile sporangia, × 20 (Warsaw: Rostafinski's type); c. capillitium and spores of the same, × 280; d. spore, × 600; e. sporangia, × 20 (England).

The American specimens of this species from Prof. Farlow and Dr. Rex are, as a rule, smaller, than the European gatherings, and the stalks, when present, are more slender.

B. orbicularata Rex appears to be a variety differing in the shape of the orbicular or discoidal, depressed sporangia.

Hab. On dead wood.—Luton, Beds. (L:B.M.7); Sutton Coldfield, Stafford (L:B.M.7); Cambridge (L:B.M.7); Holland (Leyd. Herb.); Berlin (B. M. 434); Poland (Strassb. Herb.); Italy (K. 187); Philadelphia (L:B.M.7); Arizona (L:B.M.7).


Plate IV., B.—a. sporangia, × 20 (England); b. capillitium and spores, × 280; c. spore, × 600; d. sporangia broken, showing pseudo-columella, × 20; e. sporangia of a form without columella and with a closer network of capillitium, × 20.

Badhamia verna Rost. appears to be a form of B. panicea; the specimens in Strassb. Herb. differ from the type of the latter species only in the more scanty deposits of lime, and in the narrow bands of the capillitium contracting here and there into hyaline threads. These characters frequently occur in normal British gatherings of B. panicea.

Hab. Between the bark and wood of felled elm-trees, etc. Maturing on the outer bark and surrounding herbage.—Batheaston, Somerset (B. M. 77); Lyme Regis, Dorset (L:B.M.8); France (B. M. 425); Germany (B. M. 424).

8. B. lilacina Rost., Versuch., p. 10 (1873). Plasmodium bright yellow. Sporangia subglobose, about 0·5 mm. diam., sessile, rarely shortly stalked, gregarious or crowded and angled by mutual pressure, flesh colour or whitish; sporangium-wall opaque from innate deposits of lime. Capillitium flesh coloured or nearly white; a rugged network with large knots of irregular

Plate V., A.—a. sporangia, × 20 (England); b. capillitium and spores of the same, × 200; c. spore, × 600; d. sporangium, showing a pseudo-columella, × 20 (Mecklenburg-Schwerin).

The type of Diderma concinnum Berk. & Curt., in the Kew Herb., is a pale whitish form of this species with the characteristic spores and capillitium.

Hab. On Sphagnum, twigs, etc., in marshy ground.—Pilmoor, Yorks (L.B.M.9); Scotland (Edin. Herb); Germany (B. M. 488, and Strassb. Herb.); Philadelphia (L.B.M.9).


a. genuina: spores minutely spinulose.

β. dictyospora: spores strongly warted or reticulated.—Badhamia dictyospora Rost., Mon., App., p. 4; Cooke, Myx. Brit., p. 82. Craterium dictyospermum Mass., Mon., p. 270.

Plate V., B.—a. sporangia, × 20 (England); b. broken sporangium from a mounting in glycerine jelly, showing columella surrounded by capillitium, and the mottled sporangium-wall, × 50; c. capillitium and spores, × 280; d. spore of the same, × 600; e. spore, × 600 (Deer Island, St. Lawrence); f. spore, × 600 (New Jersey); g. spore, × 600 (Appin, Scotland; Rostafinski’s type of his B. dictyospora).

Didymium Curtisi Berk. differs from the type of B. rubiginosa only in being sessile or shortly stalked; in both British and American
gatherings of the latter species, the length of the stalk is subject to great variation. B. dictyospora is the name given by Rostafinski to the Appin specimen (K. 193), in which the spores are strongly reticulated. British gatherings have more or less of this character, with prominent warts isolated or confluent; in most American specimens and in that from Chevalier at Paris, which is given by Rostafinski as the type of B. rubiginosa, the spores are minutely spinulose. There are intermediate degrees of roughness in American specimens which unite the two forms.

Hab. In woods on fallen brushwood, etc.—a. Paris (Strassb. Herb.); Philadelphia (L:B.M.10); Iowa (B. M. 815); S. Carolina (B. M. 406); New York (L:B.M.10). b. Leighton, Beds. (L:B.M.10); Appin, Argyllshire (K. 193).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

10. B. fasciculata Rost., Mon., App., p. 2 (1876). Sporangia globose, white, dehiscing irregularly, fugacious above, persistent below; stalks connected in clusters of 3 to 6 or more, erect, tough, dirty yellowish, attenuated upwards, thickened and dark at the base; spores violet, smooth, 11 to 12 μ diam.—Physarum fasciculatum Jungh., Fl. Crypt. Jav., p. 11, Pl. II., fig. 8.

Hab. On trunks of Pandanus, Java.


Hab. On dead leaves and stems. Chili (Bertero).

12. B. ovispora Racib., in Rozpr. Mat.-Przyr. Akad. Krak., xii., p. 72, tab. 4, fig. 2 (1884). Sporangia sessile, subglobose, 0·5 to 0·75 mm. broad; sporangium-wall with thick deposits of lime, rough, fragile, the base yellow, the upper part colourless; capillitium with much lime, white, rigid, with large irregular nodes. Columella none. Spores violet, smooth, ellipsoid, 14·5 to 16·5 x 7·5 to 8·3 μ.

Hab. On the branches of Populus canescens, DC. Cracow.


Hab. In decaying trunks of Cercus Peruvianus Mill.—Argentina.

14. B. microcarpa Schrot., in Cohn, Crypt. Fl. Schlesien, vol. iii., pt. i., p. 131 (1889). Sporangia sessile, about 0·5 mm. broad, occurring in small groups or rows, without a common hypo-
thallus; sporangium-wall thin, bright grey. Capillitium delicate, white, reticulate, with threads of unequal breadth, generally 3 to 4, sometimes as much as 12 \( \mu \) broad, and thicker at the nodes. Spores single, 7·5 to 9 \( \mu \) in diameter, violet, smooth.

_Hab._ On grass and living herbs.—Silesia.

15. _B. irregularis_ Cooke & Ellis, in Grev. 1877, p. 89. Sporangia subglobose or confluent, finally blackish-brown, scattered, sessile. Spores rough, globose, blackish, 10 \( \mu \) in diameter.

_Hab._ On Jersey pine in a fence.—N. Jersey.

**SPECIES EXCLUDED FROM THE GENUS.**

_B. coadinata_ Rost. = _Fuligo ellipsospora_ Lister.
_B. Fuckeliana_ Rost. = _Trichamphora pezizoidea_ Jungh.
_B. nodulosa_ Mass. = _Physarum calidris_ Lister.
_B. granulifera_ Mass. See note under _Lepidoderma Carestianum_ Rost., p. 106.

Genus 3.—**PHYSARUM** Persoon, in Usteri, Ann. Bot., xv., p. 5 (1795). Sporangia stalked, sessile or plasmodiocarps; sporangium-wall either single or consisting of two more or less separable layers, and containing lime granules distributed in loose or dense clusters or compacted into a crust; the granules always innate and not in superficial crystals. Stalk consisting of a tube with a membranous wall: it may be empty and the wall contracted and wrinkled with longitudinal folds, either translucent or opaque with deposits of lime in the wall substance; or the tube may be filled at the base or throughout with refuse matter discharged from the plasmodium; or the tube may be filled with deposits of lime, giving the stalk a brittle structure with a chalk-like section. Capillitium forming a network of hyaline threads with vesicular expansions containing deposits of lime (=lime-knots).

The genus _Tilmadoche_ is described by Rostafinski (Mon., p. 126) as differing from _Physarum_ in the capillitium forking repeatedly at a narrow angle, and being provided with few and small lime-knots. These characters are too inconstant to be of value in classification. In _P. leucophaeum_ Fr., which from its abundance affords ample facility for study, we not unfrequently observe, in a growth sprung from one plasmodium, some sporangia with capillitium characteristic of _Physarum_ and others of _Tilmadoche_, completely uniting _P. leucophaeum_ Fr. with _T. nutans_ Rost. _T. gyrocephala_ Rost. (syn. _P. polymorphum_ Rost.) frequently has capillitium with large lime-knots and broad membranous expansions, and the same may be seen in some gatherings of _P. viride_ Pers. (syn. _T. mutabilis_ Rost.). The type specimens of _T. oblonga_ Rost. and _T. hians_ Rost. are the same as _Physarella mirabilis_ Peck, which is distinguished from its allies by well-marked characters of shape and capillitium that fully entitle it to the position of a separate genus. For these reasons the genus _Tilmadoche_ is not retained.
KEY TO THE SPECIES OF PHYSARUM.

A. Sporangia stalked (occasional sessile forms):—

a. Stalks charged with lime throughout—
   a. Capillitium lax—
      Stalk white, sporangia grey, lime-knots large, white.  1. P. leucopus
      Stalk white, sporangia tawny yellow, lime-knots large, white.  8. P. melleum
      Stalk and sporangium yellow-olive.  7. P. variabile

b. Capillitium rigid, persistent—
   Stalk white or brownish, sporangium white, lime-knots small, white.  2. P. globuliferum
   Stalk, sporangium, and lime-knots red.  3. P. pulchripes
   Stalk, sporangium, and lime-knots mouse-brown.  4. P. marinum
   Stalk, sporangium, and lime-knots purple.  5. P. pulcherrimum
   Stalk, sporangium, and lime-knots yellow; robust.  6. P. citrinum
   Stalk, sporangium, and lime-knots straw-coloured; slender.  9. P. tenerum
   Stalk and sporangium white, capillitium with a central ball of lime.  10. P. compactum

b. Stalks without lime or with deposits in the wall only—
   a. Lime-knots purple-red, sporangium rose-red.  11. P. roseum

b. Lime-knots and sporangia violet-purple.  12. P. Newtoni

c. Lime-knots orange, sporangium mottled, blue and red  13. P. psittacinum

d. Lime-knots yellow or orange, sporangium grey or yellow—
   Sporangia subglobose, capillitium lax, lime-knots fusiform.  14. P. viride
   Sporangia undulate, capillitium lax, lime-knots fusiform.  16. P. polymorphum
   Sporangia subglobose, capillitium subrigid, persistent, lime-knots angular.  15. P. Berkeleyi
   Stalk penetrating the sporangium to four-fifths its height.  18. P. penetrabile
e. Lime-knots white, sporangium grey or white—
   Stalk straw-coloured, capillitium with a central ball
   of lime.  17. *P. nucleatum*
   Stalk buff, black, or white; sporangium subglobose;
   spores bright violet-brown.  19. *P. nutans*
   Stalk black, buff, or white; sporangium laterally
   compressed; spores dark purple-brown.  21. *P. compressum*
   Stalk red-brown, sporangium globose, white.
   20. *P. calidris*
   Stalk white, membranous, sporangium ovoid.
   22. *P. didermoïdes*

B. Sporangia sessile (never stalked):—

   A. Lime-knots white—
   
   a. Sporangium-wall single, spores pale violet-brown.
      23. *P. cinereum*
   
   b. Sporangium-wall double—
      a. Sporangia scattered—
      Sporangia sinuous, muriform, inner wall fragile.
      24. *P. bivalve*
      Sporangia subglobose, or plasmodiocarps, inner
      wall persistent.  25. *P. Didierma*
   
   β Sporangia crowded—
      Sporangia reniform or subglobose, spores dark,
      rough, 10 to 14 μ.  26. *P. contextum*
      Sporangia angled by mutual pressure, spores pale,
      nearly smooth, 8 to 10 μ.  27. *P. conglomeratum*

   b. Lime-knots red, or yellow—
      Lime-knots yellow, small, angular.  28. *P. virescens*
      Lime-knots red, large, angular.  30. *P. rubiginosum*
      Lime-knots yellow with red centre, rounded.
      29. *P. inaquale*

1. *P. leucopus* Link, Diss. I., p. 27 (1809). Plasmodium
   opaque white. Total height about 1 mm. Sporangia globose,
   cinereous, or glaucous, 0·5 mm. diam., gregarious, stipitate;
   sporangium-wall delicately membranous, containing scattered or
   clustered, white, globular lime-granules. Stalk white, stout,
   0·15 to 0·2 mm. thick, with a few shallow longitudinal furrows,
   erect, rigid, brittle, somewhat narrowing upwards, chalk-white
   in section to the base, rising from a more or less developed white
   hypothallus; enclosing no refuse matter. Columella none, or
   scarcely evident. Capillitium white, consisting of delicate,
   branching, hyaline threads connecting the large irregular knots,
which are 10 to 50 µ broad and filled with globular lime-granules, 1 to 1.5 µ diam. Spores violet-brown, minutely spinulose, 7 to 10 µ diam.—Rost., Mon., p. 101; Cooke, Myx. Brit., p. 12; Mass., Mon., p. 287 (in part); Macbride, in Bull. Nat. Hist. Iowa, ii., p. 156. Didymium leucopus Fr., Syst. Myc., iii, p. 121.

Plate VI., A.—a. sporangia, × 20; b. capillitium with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (England).

The snow-white nearly smooth stalk, which is chalk-white in section to the base, always distinguishes P. leucopus from P. nutans. The lax capillitium, with large lime-knots and the large lime-granules in the knots and sporangium-wall, separate it from P. globuliferum, which is its nearest ally. The types quoted by Rostafinski from Germany and Russia of this well-marked species are not represented in the Strassburg or British collections; the stations here given are therefore confined to those of the English and American gatherings. It is not common; the only specimen in the Kew collection (K. 518), leg. J. Henderson, is named Didymium squamulosum.

Hab. On dead leaves, moss, etc.—Batheaston, Somerset (B.M. 48); Lyme Regis, Dorset (L:B.M.11); Ohio (L:B.M.11); New Granada (Paris Herb.).

2. P. globuliferum Pers., Syn., p. 175 (1801). Plasmodium? Total height 1 to 1.5 mm. Sporangia globose, stipitate, erect, white, gregarious, 0.5 mm. diam.; sporangium-wall membranous, with crowded clusters of innate lime-granules. Stalk white or pale buff, sometimes red-brown towards the base, 0.5 to 1 mm. long, 0.05 to 0.1 mm. thick, nearly smooth, brittle, chalky in section. Columella conical. Capillitium persistent, retaining the form of the sporangium after the dispersion of the spores, forming a close network of obtusely branching hyaline threads with numerous fusiform or rounded, white, or pale ochraceous lime-knots 10 to 20 µ diam.; the lime-knots are not usually developed at the axils of the branches, which are flat and triangular, or if present, usually minute. Spores violet-brown, almost smooth, 6 to 8 µ diam. Rost., Mon., p. 98, fig. 86; Mass., Mon., p. 297. Sphaerocarpus globuliferus Bull., Champ., p. 134, Pl. 484, fig. 3 (1791). Physarum Petersii Berk. & Curt., var. a. Farlowii Rost., Mon., App., p. 6. Physarum albicans Peck, in Rep. New York Mus., xxx., p. 50; Mass., Mon., p. 312. Didymium Barteri Mass., Mon., p. 231. Physarum columbinum Macbride, in Bull. Nat. Hist. Iowa, ii., p. 384.

Plate VI., B.—a. sporangia, × 20, in two the sporangium-wall has fallen away, leaving the persistent head of capillitium; b. stalks showing the columella after the capillitium has broken away, × 20; c. capillitium, columella, and spores, × 280; d. spore, × 600 (United States).

The types of P. Petersii var. a Farlowii Rost., and P. albicans Peck are the same species as the type of P. globuliferum in the Strassburg collection. P. columbinum Macbride, from Iowa (B.M. 1012), is also P. globuliferum; it has snow-white, occasionally red-brown, stalks, and well-developed conical columella. Didymium Barteri Mass. (K.74) appears to have been rightly named by Rostafinski "P. globuliferum, immaturum"; the specimen is obscured by mould. In the specimen
from Dr. Rex (L:B.M.12) marked "P. Petersii var. Furlowii, conglobate form," the sporangia are in clusters of from 6 to 14 together, as in the compound forms of *P. polymorphum*.

*Hab.* On dead wood.—Poland (Strassb. Herb); Africa (K. 74); Bonin Island (K. 333); Borneo (L:B.M.12); Ohio (L:B.M.12); Iowa (B.M. 1012, 1015); Georgia (B.M. 833b); conglobate form, Philadelphia (L:B.M.12).

3. *P. pulchripes* Peck, in Bull. Buff. Soc. N. Hist., i., p. 64 (1873). Plasmodium? Total height 1 to 2 mm. Sporangia globose, stipitate, yellow-orange, orange-red to dark brown, sometimes grey from the absence of lime, about 0·5 mm. diam.; sporangium-wall membranous, with deposits of lime usually abundant, sometimes scanty. Stalk vermilion-red or red-brown, 0·5 to 1·5 mm. long, 0·1 mm. thick, somewhat narrowed upwards, densely charged with red or brown lime-granules, brittle. Columella conical. Capillitium with red or brown lime-knots, in other respects as in *P. globuliferum*. Spores violet-brown, almost smooth, 6 to 8 μ. diam.—Mass., Mon., p. 315. *Didymium erythrinum* Berk., in Grev., ii. (1873), p. 52; Mass., Mon., p. 249. *Didymium Ravenelii* Berk. & Curt., in Grev., ii. (1873), p. 53; Physarum Ravenelii Mass., Mon., p. 281.

Plate VII., A.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (United States).

A frequent species in the United States, differing from *P. globuliferum* chiefly in the colour of the lime; and this character appears to be constant. Under *P. pulchripes* are included *Didymium erythrinum* Berk. and *D. Ravenelii* Berk. & Curt., which Rostafinski in the Appendix to his Mon., p. 8, has placed under *Physarum paillucinum*, a species without columella and without lime-granules in the stalk. Examination of the types in the Kew collection shows that the sporangia of *D. erythrinum* (K. 1265) are immature, but those of *D. Ravenelii* (K. 1513 and B.M. 569) possess a well-developed columella, and the stalks in both types are densely charged with lime-granules.

The type of *P. Petersii* Berk. & Curt. in Grev., ii., p. 66 (1873); Rost., Mon., App., p. 6 (K. 1254), belongs also to *P. pulchripes*. So much confusion has been caused by Berkeley and Curtis in giving different names to different gatherings of this species, and by Rostafinski in placing *P. globuliferum* as a variety of *P. Petersii*, that Peck’s name is adopted as being free from ambiguity.

*Hab.* On dead wood.—Massachusetts (L:B.M.13); Ohio (L:B.M.13); N. Carolina (B. M. 569, 852a).

4. *P. murinum* Lister sp. nov. Plasmodium? Sporangia globose, about 0·5 mm. diam., stalked or sessile and forming plasmodiarchs, pinkish or yellowish brown, rugose; sporangium-wall membranous, with innate clusters of brown lime-granules. Stalk erect, 0·5 mm. long or shorter, 0·1 mm. thick, of equal breadth throughout; pale brown, furrowed, containing dense deposits of white lime-granules. Columella present in the stalked forms, conical. Capillitium forming either a dense network of obliquely branching hyaline threads, persistent after the dispersal of the
spores, with rather few ovoid brown lime-knots, or a looser network of hyaline threads, with numerous elongated irregularly branching lime-knots. Spores pale brownish-violet, nearly smooth, 8 to 10 \( \mu \) diam.—*P. Braunianum* List. in Journ. Bot. 1891, p. 259 (non de Bary).

Plate VII., B.—*a*. sporangia, \( \times 20 \); *b*. plasmodiocarp, \( \times 20 \); *c*. capillitium and spores, \( \times 280 \); *d*. spore, \( \times 600 \) (United States).

This species is closely allied to *P. globuliferum*, from which the stalked form scarcely differs except in the brown colour of the lime in the capillitium and sporangium-wall. The specimen from Moffat, described in Journ. Bot., 1891, under the name *P. Braunianum* de Bary, agrees with de Bary's description of that species in the usually sessile form and brown lime-knots of the capillitium, but as the type consists of only a single gathering by A. Braun near Berlin, and is not represented in the Strassburg or British collections, no proof of identity has been obtained; the Moffat specimen is therefore placed under *P. murrinum*, the sessile American forms of which it closely resembles.

*Hab.* On dead leaves, wood, etc.—Moffat (L:B.M.14); Philadelphia; (L:B.M.14); Ohio (L:B.M.14).

5. *P. pulcherrimum* Berk. & Rav., in Grev., ii., p. 65 (1873). Total height 1 mm. Sporangia globose, flattened beneath, stipitate, erect or inclined, purple, 0·4 to 0·5 mm. diam., gregarious. Sporangium-wall membranous, pale purple, with scattered clusters of large purple globular lime granules (1 \( \mu \) diam.) Stalk purple, subulate, brittle, containing lime. Columella small, convex, or none. Capillitium a close network of delicate purplish threads, broader and more expanded at the axils below; lime-knots numerous, small, roundish, filled with purple globular lime-granules. Spores pale dull red, almost smooth, 7 to 8 \( \mu \) diam. —Rost. Mon., p. 105, fig. 84; Mass., Mon., p. 293. *Physarum atrorubrum* Peck, in Rep. New York Mus., xxxi., p. 40; Mass., Mon., p. 294.

Plate VIII., A.—*a*. sporangia, \( \times 20 \); *b*. capillitium with fragment of sporangium-wall and spores, \( \times 280 \); *c*. spore, \( \times 600 \) (United States).

*P. atrorubrum* Peck is the same species (teste Dr. G. A. Rex).

*Hab.* On dead wood.—Ohio (L:B.M.15); Philadelphia (L:B.M.15); Iowa (B.M. 1013); S. Carolina (B. M. 412, 869).

6. *P. citrinum* Schumacher, Enum. Pl. Saell., ii., p. 201 (1803). Plasmodium? Total height 0·8 to 2 mm. Sporangia globose, rugose, stipitate, rarely nearly sessile, erect, yellow to yellowish grey, 0·4 to 0·7 mm. diam.; sporangium-wall membranous with innate clusters of yellow lime granules. Stalk golden yellow, opaque with dense deposits of lime, stout, somewhat furrowed, varying in length, chalky in section, often rising from a vein-like hypothallus. Columella short, conical, or obtuse. Capillitium a somewhat close network of hyaline rigid threads with flat expansions at the axils, persistent after the dispersion of the spores; lime-knots yellow, numerous, varying in shape and size, usually rounded, seldom developed at the axils of the branches.
Spores violet-brown, almost smooth, 7 to 8 μ diam.—Rost. in
Sys. Veg., iv., p. 528; Rost., Mon., p. 98, App., p. 6; Cooke,
App., p. 7; Mass, Mon., p. 296.

Plate VIII. B.—a. sporangia, × 20; b. capillitium and spores, × 280;
c. spore, × 600 (England); d. sporangium showing columella, × 20 (Ger-
many, Strassburg Herb.).

P. Kalchbrenneri Mass., from the Cape (K. 347), is allied to P. cit-
trinum, differing chiefly in the capillitium, which approaches that of
Badhamia; the nodes are irregularly expanded, bright yellow, and
connected by more or less hyaline strands, 2 to 5 μ broad; columella
none, spores 8 to 10 μ. Rostafinski separates P. Schumacheri, vars.
β and γ, Mon., p. 99, and places them in his Appendix under the name
of P. Leveillei; the type specimen of var. β from Freiburg in the
Strassburg collection is a large form of P. citrinum, but is fully
equalled by the English gathering figured; the spores measure 8 to
9 μ; the type of var. γ from Munster is a very different form, and
appears to be more nearly allied to P. rubiginosum. The specimen
from Venezuela in the Kew collection, marked by Rostafinski P. Leveillei
var. β, has a longer stalk than the typical P. citrinum, a more lax
capillitium, and the spores measure 10 μ, but it can scarcely be viewed as
a distinct species.

Hab. On dead wood, moss, etc.—Bedfordshire (L:B.M.16); Germany
(Stassb. Herb); Freiburg (L:B.M.16; Venezuela (K. 1261).

Plasmodium? Total height about 1 mm. Sporangia piriform,
ovoid, or subglobose, 0.4 to 0.5 mm. broad, stalked or sessile,
rugose, somewhat glossy, yellowish olive; sporangium-wall mem-
branous, with dense innate deposits of yellowish lime-granules.
Stalk stout, conical, furrowed, 0.4 mm. high or less, yellowish-
brown, densely charged with white lime-granules. Columella
none. Capillitium a close network of delicate hyaline threads
with membranous expansions at the axils of the branches; lime-
knots numerous, irregularly branching, many large and confluent,
white or pale yellow. Spores brownish-violet, spinulose, 9 to 12 μ
diam.

Plate IX., A.—a. sporangia, × 20; b. broken stalk showing lime; c. capil-
litium, with fragment of sporangium-wall and spores, × 280; d. capil-
litium, × 600 (United States).

Hab. On dead wood.—Iowa (B.M. 812); New York (L:B.M.17);
Venezuela (L:B.M.17).

Total height 0.8 mm. Sporangia globose, stipitate, erect, brown-
ish-yellow, 0.5 μ diam.; sporangium-wall membranous, often
wrinkled, persistent at the base, yellowish, with minute coloured
lime granules sparsely distributed. Stalk white or faintly buff
coloured, stout, opaque, with few shallow furrows, chalky in
section. Columella short, conical. Capillitium of irregularly-
branched delicate hyaline threads, sometimes expanded at the

Plate IX., B.—a. sporangia, and one stalk showing a small columella, × 20; b. broken sporangia showing white capillitium, × 20; c. capillitium and fragment of sporangium-wall, × 280; d. spore, × 600 (United States).

Allied to P. citrinum, but constant in its characters; of frequent occurrence in the United States.

Hab. On dead wood, leaves, etc.—Cape (K. 57); Ceylon (B.M.411); Borneo (K. 1257); Philadelphia (L:B.M.18); Ohio (L:B.M.18); Iowa (B.M. 1018); S. Carolina (B. M. 409, 853A).

9. P. tenerum Rex, in Proc. Acad. Nat. Sc. Phil. 1890, p. 192. Plasmodium? Total height, 1 to 2 mm. Sporangia globose, stipitate, somewhat nodding, gregarious, yellow, 0·4 mm. diam.; sporangium-wall membranous with closely-set rounded thin clusters of innate yellow granules. Stalk subulate, slender, opaque, 0·5 to 1·7 mm. long, pale yellow and filled with lime above, darker below from the presence of refuse matter. Columella none. Capillitium of very delicate hyaline threads forming a regularly meshed network, often persistent after the dispersion of the spores, with numerous round or rounded yellow lime-knots, the branches slender at the axils and mostly free from lime. Spores violet-brown, nearly smooth, 7 to 8 μ diam.

Plate X., A.—a. sporangia, × 20; b. stalk and capillitium, × 170; c. capillitium and spores, × 280; d. spore, × 600 (United States).

This species is closely allied to P. citrinum, differing in the more slender form, in the delicate flexuose capillitium threads connecting the lime-knots, and in the absence of a columella. Specimens sent by Dr. Haviland from Borneo are similar to the type of Dr. Rex. A gathering from Mr. Morgan, Ohio, has small grey sporangia, 0·25 mm. diam., rugose, with deposits of white lime-granules in the sporangium-wall; in other respects it is typical.

Hab. On dead wood.—Borneo (L:B.M.19); New York (L:B.M.19); Ohio (L:B.M.19).

10. P. compactum Lister. Plasmodium? Total height 1 to 2 mm. Sporangia globose or somewhat flattened below, 0·5 mm. diam., stipitate, erect or nodding, spotted with pure white; grey or bronze colour and iridescent between the rounded spots; sporangium-wall membranous, with numerous well defined rounded clusters of closely compacted lime granules. Stalk erect or flexuose, subulate, furcate, 0·5 to 1·5 mm. long., 0·05 to 0·13 thick at the base; white and densely charged with lime above, brown or black below from the presence of refuse matter; or white with chalky section to the base. Columella none, or represented by closely compacted lime-knots forming a globular cluster 0·1 mm. diam. at the apex of the stalk, but lying free in the

Plate X., B.—a. sporangia, × 20; b. stalk and capillitium with pseudo-columella and fragment of sporangium-wall, showing compacted and sharply-defined clusters of lime-granules, × 80; c. capillitium and spores, × 280; d. spore, × 600 (Dominica).

An excellent account of this species is given by Mr. Wingate (l.c., p. 48). He describes the sporangium-wall as splitting on maturity in a floriform manner, which is a marked character in the specimens at hand; his description of the stalk as "yellowish-white with a brown or blackish base" appears to be correct for the American gatherings. In a fine specimen of P. compactum in the Kew collection from Dominica (Ramage), K. 567, marked Lepidoderma stellatum Mass., the stalks are pure white with a chalky section to the base. The specimen from French Guiana in the Paris Museum under the name Physarum tenuoporum is precisely similar to that from Dominica in the large opaque white lime-spots on the sporangium-wall and in the pure white stalks. The type of Didymium colombiunum Berk. & Curt. (Tilmadoche colombiunum Rost., Mon., App., p. 13), Venezuela (K. 1428), appears to be this species, but nothing now remains of the specimen but a few stalks and a little of the extremely delicate capillitium.

Hab. On dead wood.—Borneo (L:B.M.20); Dominica (K. 567); Philadelphia (B. M. 875, L:B.M.20); Ohio (L:B.M.20); French Guiana (Paris Herb.).


Plate XI., A.—a. sporangia, × 20; b. capillitium with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (Borneo).

This species differs from P. pulcherrimum in the large lime-knots and the translucent stalk.

Hab. On dead wood.—Ceylon (K. 1758); Borneo (L:B.M.21).

12. P. Newtoni Macbride, in Bull. Nat. Hist. Iowa, vol. ii., 4, p. 390 (1893). Plasmodium? Sporangia shortly stalked or sessile, globose, about 0·5 mm. diam., or flattened and umbilicate above, violet-purple, smooth, opaque; sporangium-wall membranous above, with innate deposits of purple lime-granules, rugose and thickened towards the base, where it is deep purple
and densely charged with calcareous deposits. Stalk coarsely wrinkled, purple-brown. Columella none. Capillitium of delicate, branching, violet threads, with numerous large, angular, purple lime-knots. Spores dark purple-brown, rough with irregularly scattered warts 8-10 μ diam.

Plate XVII., B.—a, stalked and sessile sporangia, × 20; b, capillitium and spores, × 280; c, spore, × 600 (Colorado).

The shape of the sporangia and the dark rough spores appear to be the only points which distinguish this species from Cryderium rubescens Rex, with which it agrees in colour, in the character of the capillitium, and in the structure of the sporangium-wall.

Hab. On sticks, on mountain, Colorado (B. M. 1014).

13. P. psittacinum Ditm., in Sturm, Deutsch. Fl., Pilze, p. 125, t. 62 (1817). Plasmodium orange, in the substance of rotten wood. Total height 1 mm. Sporangia globose or somewhat depressed, stipitate, gregarious, 0.5 to 0.8 mm. diam., purplish-blue mottled with red, iridescent; sporangium-wall hyaline, delicately membranous, sprinkled with orange spots of thicker, more or less granular substance. Stalk equal, erect or curved, furrowed and rugose, vermilion or orange-red, intense clear orange in mountings in glycerine, without deposits of lime, rising from a well-developed hypothallus of the same colour, 0.5 to 0.7 mm. long, 0.1 mm. thick. Columella none. Capillitium a close network of flat, arching, colourless or yellowish threads, broad at the axils; lime-knots numerous, varying in size, sharply angular, often branching, or confluent in the centre of the sporangium, bright orange, obscurely granular or translucent. Spores fuliginous-violet, smooth or nearly so, 7 to 8 μ diam.—Rost., Mon., p. 104, figs. 75, 76; Lister in Journ. Bot. 1891, p. 257, Pl. 308, fig. 1; Mass., Mon., p. 274. P. Carlylei Mass., Mon., p. 293.

Plate XI., B.—a, sporangia, × 20; b, capillitium with fragment of sporangium-wall showing crystalline discs, × 280; c, spore, × 600 (England).

The specimens in the Kew collection named Didymium erythrinum Berk. and D. Roccetellii Berk. & Curt., given by Rostafinski as synonyms of P. psittacinum, must be referred to P. pulchripes. The type specimens of P. psittacinum in the Strassburg collection are of the form described above. The type specimen of P. Carlylei Mass. (K. 68) is normal P. psittacinum. In glycerine montagings, flattened disc-shaped crystalline bodies with radiating structure are usually seen imbedded in the sporangium-wall, as in P. virescens var. genuina.

Hab. On dead wood.—Germany (B. M. 1109); Poland (Strassb. Herb.); New York (K. 1266); Carlisle (K. 68); Lyme Regis, Dorset (L:B.M.22).

14. P. viride Pers., in Usteri, Ann. Bot., xv., p. 6 (1795). Plasmodium yellow, in rotten wood. Total height 1 mm. Sporangia globose, lenticular, stipitate, nodding, 0.3 to 0.5 mm. diam., yellow, greenish, or orange; sporangium-wall membranous with innate clusters of yellow or orange lime-granules more or less closely disposed. Stalk subulate, slender, striate, grey or straw-coloured, often darker below from enclosed refuse matter, without deposits


β. *aurantium*: sporangia orange.—*Sphaerocarpus aurantius* Bull., Champ., Pl. cceelxxiv., fig. 2.

γ. *incanum*: sporangia grey.

Plate XII. A.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (England).

In this variable species, as in *P. mutans*, the sporangium-wall is somewhat persistent when the lime is abundant; when this is more scanty the wall soon breaks up in small fragments, remaining attached to the capillitium. The colour of the sporangia found on the same stump may differ from one year to another. The lime-knots are very variable both in size and colour; pale yellow sporangia have often red-brown knots, and dark sporangia have light orange knots; occasionally the sporangia are grey and the lime-knots pale yellow, approaching *P. mutans*. The stalks vary in tint in all forms. The specimens from Chili (Gay) in the Paris Museum, given by Rostafinski (Mon., App., p. 7) as a type of *Physarum Leveillei*, is the orange form of *P. viride*; the stalks are free from lime deposit, the capillitium consists of slender threads and fusiform orange lime-knots.

Hab. On dead wood.—a. and β. Leytonstone, Essex (L:B.M.23); France (Paris Herb.); Germany (B .M. 506); Borneo (L:B.M.23); New Jersey (L:B.M.23). β. Poland (Strassb. Herb.); Ceylon (K. 1420); Bouin Islands (K. 335); Chili (Paris Herb.). γ. Bohemia (B. M. 503); Iowa (B. M. 805).

15. *P. Berkeleyi* Rost., Mon., p. 105, fig. 88 (1875). Plasmodium yellowish-green (teste Ravenel). Total height 1.75 mm. Sporangia subglobose, or flattened beneath, stipitate, nodding, 0.4 to 0.5 mm. diam., grey and yellow at the base, yellow or iridescent from the absence of lime; sporangium-wall membranous, colourless above, thicker and yellowish below. Stalk slender, subulate, striate, without deposits of lime, red or copper coloured. Columella none. Capillitium a close network of delicate hyaline threads with numerous yellow flat expansions at the axes; often persistent and retaining the form of the sporangium after dispersion of the spores; lime-knots usually small, angular, yellow. Spores pale violet-brown, almost smooth, 7 to 9 μ diam.—*Physarum flavicolum* Berk., in Hook. Journ. Bot., iv., 1845, p. 66. *Physarum cupripes* Berk. & Rav., in Grev., ii., p. 65, 1873; Mass., Mon., p. 284. *Didymium flavicolum* Mass., Mon., p. 242.

Plate XII., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (United States).

The red-brown stalks and the larger expansions of the capillitium at the axils of the branches distinguish this species from P. viride. P. galbeum Wing.* (L:B:M.24) has globose orange-yellow sporangia, and orange-brown stalks entirely free from lime; the capillitium is a close network of threads expanded and flattened at the axils, with few or no deposits of lime. Similar forms have been found near Lyme Regis. They are here included under P. Berkeleyi, but other gatherings from Lyme Regis connect these forms with P. viride, making it doubtful whether P. Berkeleyi is not merely a marked variety of that species. The specimen from Iowa (B. M. 1017) resembles the type of P. galbeum, except that the capillitium consists of a close network of large branching knots, densely charged with yellow lime-granules, connected by few branching hyaline threads; the spores measure 8 μ. This form is nearly related to a specimen from Mossman’s Bay, Sydney, Australia (K. 346), marked Tilmadoche mutabilis, with capillitium of a Badhamia-like character, the threads being charged throughout with yellow lime-granules; the spores are spinulose and measure 10 to 13 μ. This is connected with P. viride by a series of intermediate specimens from Ceylon (also in Kew Herb.) with unusually extended lime-knots and large spores, but the rigid persistent capillitium brings it under the definition of P. Berkeleyi.

Hab. On dead wood.—Swan River, Australia (K. 1328); Iowa (B. M. 1017); So. Carolina (B. M. 439, 870, 493); Massachusetts (L:B:M.24).


a. obscurum: sporangia simple.

b. gyrocephalum: sporangia clustered.
Plate XIII. A.—a. sporangia closely combined, \( \times 20 \); b. sporangia more or less simple, \( \times 20 \); c. capillitium and spores, \( \times 280 \); d. spore, \( \times 600 \) (United States).

Under *P. polymorphum* is included *Didymium obrusseum* Berk. & Curt. and *Tilmadoche gyrocephala* Rost. I have not seen Rostafinski’s types of the latter. The specimens issued by Ellis and Everhart, 2699 N. A. F., and those received from Dr. Rex of Philadelphia and Prof. Macbride of Iowa, under the name *T. gyrocephala*, agree with the description given by Rostafinski. The colour of the sporangia varies from grey to yellow in the same gatherings. Examination of the capillitium and spores of these specimens and of the types of *P. obrusseum* and *P. polymorphum* shows that they are essentially alike; of the characters given above the clustering of the sporangia cannot be held as of specific importance (cf. *P. globuliferum*). In the type of *Didymium obrusseum* Berk. & Curt., No. 532 F. Cub. (B. M. 440), the sporangia are much compressed and undulated, and are similar to the simple sporangia frequently met with in *P. polymorphum*.

Hab. On dead wood, etc.—a. and \( \beta \). So. Carolina (B. M. 856, 862). a. Cuba (B. M. 440). \( \beta \). Pennsylvania (B. M. 860); Iowa (L:B.M.25); Ohio (L:B.M.25); Long Island, N. Y. (B. M. 1054).

17. *P. nucleatum* Rex, in Proc. Ac. Nat. Sc. Phil. 1891, p. 389. Plasmodium? Total height 1 to 2 mm. Sporangia globose, stipitate, erect or inclined, 0.5 mm. diam., white; sporangium-wall membranous, with scattered innate clusters of white lime-granules. Stalk subulate or nearly equal, 0.7 to 1.5 mm. long, longitudinally rugose, pale buff, translucent above, without deposits of lime, enclosing refuse matter below. Columella none. Capillitium a very close network of delicate colourless threads, equal or with triangular expansions at the axils, with scattered minute rounded white lime-knots; persistent after the dispersion of the spores. In the centre of the capillitium is suspended a calcareous shining white ball, 0.1 to 0.15 mm. diam., sometimes replaced by a compacted mass of irregular lime-knots. Spores violet-brown, minutely spinulose, 6 to 7 \( \mu \) diam.

Plate XIII. B.—a. sporangia with the spores dispersed and only the basal part of the sporangium-wall remaining, \( \times 20 \); b. stalk and capillitium showing the central ball of lime, \( \times 80 \); c. capillitium and spores, \( \times 280 \); d. spore, \( \times 600 \) (United States).

The type specimen of *P. simile* Rost., from Curtis, South Carolina (K. 1255), has buff stalks without lime deposits, and delicate persistent capillitium with a central mass of lime; it is a poor development and in imperfect preservation, but there can be little doubt that it is the same species as *P. nucleatum*, although Rostafinski’s description of *P. simile* with the stalk continued into the sporangium as a cylindrical columella would apply better to *P. globuliferum* (Rost., Mon., App., p. 6).

Hab. On dead wood.—Pennsylvania (L:B.M.26); Iowa (B. M. 1019).

18. *P. penetrable* Rex, in Proc. Ac. Nat. Sc. Phil. (1891), p. 389 Plasmodium? Sporangia erect, ellipsoid, rarely globose, 0.3 \( \times \) 0.5 mm. by 0.5 \( \times \) 0.7 mm., stipitate, grey or pale greenish-yellow; sporangium-wall membranous, rather firm, semi-trans-
parent, with innate scattered clusters of pale yellow or yellowish-grey lime-granules; rupturing when mature into from two to four segments. Stalk erect or recurved, 0.5 to 2 mm. high, slender, subulate, translucent, dull red or golden red. Columella formed by a continuation of the stalk, penetrating the sporangium to about four-fifths its height, slender; scarcely tapering to the wedge-shaped end, reddish-yellow. Capillitium a close network of hyaline threads with triangular expansions at the axils of the branches, arising from the whole length of the columella, persistent after the dispersion of the spores; lime-knots scattered, small, rounded, yellow. Spores pale brownish-violet, delicately spinulose, 5 to 6.5 μ diam.

Plate XIV., A.—a. sporangia, ellipsoid form, × 20; b. sporangia, globose form, × 20; c. apex of stalk bearing the columella and capillitium, × 100; d. capillitium and spores, × 280; e. spore, × 600 (United States).

An immature specimen of this species occurs in the Strassburg collection named by Rostafinski "Craterium leucocephalum unrefr." It agrees in all respects with the American type of P. penetrare, and is interesting as being apparently the only European gathering.

Hab. On dead wood and moss.—Germany (Strassb. Herb.); Philadelphia (L.B.M.27)

19. P. nutans Pers., in Usteri, Ann. Bot., xv., p. 6 (1795). Plasmodium watery white or yellowish-grey from the presence of foreign matter. Total height 1 to 1.5 mm. Sporangia subglobose, more or less flattened or concave beneath, 0.4 to 1 mm. broad; white, greyish-white, or violet-grey; gregarious, stipitate, sessile, or plasmodiocarps; sporangium-wall membranous, with innate minute white granules in more or less dense clusters. Stalk subulate, longitudinally wrinkled, cernuous or erect, yellowish, olivaceous or dark, translucent above, sometimes opaque and white from deposits of lime in the wall, the tube of the stalk containing refuse matter but not lime (never with chalk-white fracture at the base as in P. leucopus). Columella none. Capillitium of colourless threads, either slender, forked and anastomosing with few flat expansions at the axils and few small white lime-knots, or with broad, often perforated expansions and large lime-knots. Spores clear violet-brown, nearly smooth or minutely spinulose, 8 to 11 μ diam.—Pers., Syn., p. 171; Fr., Syst. Myc., iii., p. 128. Tilmadoche nutans Rost., Mon., p. 127; Cooke, Myx. Brit., p. 21; Mass., Mon., p. 327. Physarum leucocephum, Fr., Sym. Gast., p. 24 (1818); Rost., Mon., p. 113, figs. 77, 78, 89; Cooke, Myx. Brit., p. 15; Mass., Mon., p. 288. Physarum gracilentum Fr., Syst. Myc., iii., p. 133 (1829). Tilmadoche gracilenta Rost., Mon., p. 129; Mass., Mon., p. 330. Physarum granulatum Balf., in Grev., vol. x. (1882), p. 115; Mass., Mon., p. 289. Physarum Readeri Mass., Mon., p. 282.

An extremely variable species; the stalked and plasmodiocarp forms may develop from the same growth of plasmodium. Sporangia may be found with delicate capillitium and few minute lime-knots, associated with others from the same plasmodium with wide expansions at the
angles of the threads and with large lime-knots; some may have erect stalks enclosing much refuse, standing with others more weakly formed, containing little refuse matter and cernuous from the weight of the sporangium. As in all the Calcarinaceae the amount of lime in the sporangium-wall is liable to great variation; where the supply is abundant it gives firmness and persistence to the membrane; where it is scanty the wall is fragile or evanescent, as in the form named Tilmaodoche nutans. In contrast with the latter, a robust form occurs, having a short stout stalk, often projecting within the sporangium in a conical point, with lime-knots of large size, either distributed among the capillitium or confluent in the centre; between these extreme forms all shades of difference may be found, making it difficult to define even distinct varieties. Examination of a large series leads to the conclusion that P. leucophaeum is not a distinct species, but must be included under P. nutans. The name P. leucophaeum has been so long established as applied to a well-recognised form, that it would have been desirable in some respects to retain it as representing the type of this species; but as the name P. nutans was given by Persoon twenty-three years earlier than that by Fries, the rules of precedence necessitate its adoption.

The diverging forms may be approximately described as follows, being arranged according to the amount of lime in the sporangium-wall and capillitium.

a. violascens Rost., Mon., p. 114; sporangium-wall iridescent, fragile, free from lime; capillitium without lime-knots, stalk cernuous. Spores nearly smooth, 8 to 9 μ diam.

β. genuinum: sporangium-wall with thin, innate clusters of lime-granules, fragile; capillitium slender with few flat expansions at the angles and few small lime-knots; stalk cernuous. Spores nearly smooth, 8 to 9 μ diam. Tilmaodoche nutans Rost., Mon., p. 127.

γ. leucophaeum: sporangium-wall with abundant lime, somewhat persistent, capillitium with flat, often perforated expansions at the axils, especially towards the base of the sporangium, lime-knots many or few, fusiform or rounded, 5 to 20 μ diam.; sessile forms frequent; stalk erect or cernuous. Spores 8 to 10 μ diam. P. leucophaeum Fr., Sym. Gast., p. 24.

δ. robustum: sporangium-wall with dense deposits of lime, persistent. Capillitium stout, with wide flat expansions, lime-knots rounded or angular, 20 to 50 μ broad, sometimes confined to the centre of the sporangium and confluent. Plasmodiocarp forms frequent. Stalk short, erect, stout. Spores more distinctly warty, 9 to 11 μ diam.

Plate XV., A.—a. sporangia of form β, × 20; b. capillitium and spores, × 280; c. spore, × 600; d' and d'. sporangia of form between β and γ, × 20; e. capillitium of d with abundant lime-knots, × 280; f. capillitium of d', with few minute lime-knots, × 280 (England).

B.—a. sporangia of form γ, × 20; b. capillitium and spores, × 280; c. sporangia of form δ, × 20; d. capillitium and spores, × 280; e. spore, × 600 (England).

The type of Til. gracilenta Rost., in the Strassburg collection, has small, nearly globose sporangia of the form β, and of a greyish-white
or greyish-violet colour, as given by Rost., Mon., p. 120, and not "fusco-atra" (Sacc., Syll., p. 360). The specimen named Til. gracileata from Sowerby's Herb. (K. 1419) approaches the form δ, with stout dark stalk. Physarum Readeri Mass., from Melbourne (K. 500), is the
form γ, with spores 8 to 9 μ diam. The type of P. grandutatum Balf. fil. (K. 67) is the form γ, with the lime on the sporangium-wall in sand-like granules, a not infrequent appearance in species of Physaraceae (cf. P. compressum). P. Muscicola Pers. is referred to by Persoon in Syn. Fung. 1801, p. 171, as only to be distinguished from the somewhat larger species P. mutans; it would therefore appear to be a small form of variety β. Tilmadoche Pini Rost., Mon., p. 128, is described as similar to P. mutans, but of erect and somewhat larger growth, and more robust.

Hab. On rotten stumps, etc.—Leytonstone, Essex; Lyme Regis, Dorset (L:B.M.28); γ, France (Paris Herb.); a β γ δ, Germany and Poland (Strassb. Herb.); γ, Italy (B. M. 435); γ, Australia (K. 500); β, Tasmania (K. 1403), New Zealand (K. 1243); β and γ, N. America (L:B.M.28).

20. P. calidris Lister, in Journ. Bot. 1891, p. 258, Pl. 308, fig. 2. Plasmodium? Total height 1 to 2 mm. Sporangia sub-globose, stipeulate, erect or somewhat inclined, scattered, 0·5 mm. diam., white, rugose; sporangium-wall membranous, colourless above, with dense clusters of innate white granules; thickened and persistent at the base, partaking of the colour of the stalk. Stalk subulate or equal, furrowed, 1 to 1·5 mm. long, 0·1 mm. thick, red-brown, clear orange-brown in glycerine-jelly mounting, not enclosing refuse matter, or rarely, at the base. Columella none. Capillitium of colourless branching threads with numerous or few white lime-knots; rather various in the same development, either delicate or approaching the type of Badhania. Spores pale brownish-violet, almost smooth, 8 to 11 μ diam.—Didymium usillum Berk. & Curt., Grev., ii. (1873), p. 53. Badhania nodu-
osa Mass., Mon., p. 322.

Plate XIV, B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (England).

The specimen in Broome's Herb. named P. elephntinum Berk. & Br. MS. from Ceylon (B. M. 453) is a somewhat larger form, but appears to be the same species, with capillitium and spores similar to those in the English gatherings. P. nodulorum Cooke & Balf. (B. M. 858), from South Carolina, differs from the English specimens of P. calidris only in the Badhania-like capillitium. In the Lyme Regis gatherings this character is very inconstant; in one sporangium the hyaline threads may be abundant, either delicate or with broad expansions, and the lime-knots scattered; in another the hyaline threads may be few, with the capillitium consisting chiefly of confluent lime-knots. In the sporangium examined of the Orton specimen (K. 1411) the capillitium, for a great part, consists of a network of broad strands more or less filled with lime, of Badhania type; the remainder has numerous lime-knots connected by delicate hyaline threads. The type of Didymium pusillium Berk. & Curt., from South Carolina (K. 1492), consists of specimens on two slips of wood, on one of which are three small sporangia of a Physarum with orange translucent stalks, no columella,
and capillitium with white lime-knots, answering to Berkeley's description of *D. pusillum* (Grev., ii., 1873, p. 53) and to that given above of *Physarum calidris*. On the other slip of wood are several specimens of a *Didymium* with orange stalks, crystalline deposits of lime on the sporangium-wall, and a large white columnula. These resemble the type and correspond with Berkeley's description of his *D. proximum* (Grev., ii., 1873, p. 52), which is the same species as *D. xanthopus* Fr. Owning to the combination of these two specimens, Rostafinski has given *D. pusillum* as a synonym for *D. proximum*, only noticing the characters of the latter. The first part of Saccardo's description of *D. proximum* (Syll., vii., p. 380) is taken from Berkeley's account of *D. pusillum* in Grevillea, i.e., while the second part is a translation of Rostafinski's account of *D. proximum*; hence a confusion has arisen, and it would be well if the name *D. pusillum* Berk. were dropped, or retained only as a synonym for *P. calidris*.

Hab. On dead leaves, etc.—Lyme Regis, Dorset (L:B:M.29); Luton, Beds. (L:B:M.29); Wothorpe, Northampton (K. 1549); Orton, Leicester (K. 1411); Linlithgow (K. 1504); France (Paris Herb.); Parma (B. M. 496); Ceylon (B. M. 553); S. Carolina (B. M. 558).


The sporangia of *P. compressum* vary extremely in shape and general appearance, and in some forms resemble those of the following allied species, from which they may be distinguished by the characters as under:—From *P. mutans* by the abundant lime-knots and dark spores; from *P. cinereum*—the sessile forms are separated by the dark spores; from *P. didermoides* by the presence of refuse matter in the stalk and by the single sporangium-wall; from *P. bivale* by the darker spores and shorter plasmodiocarps.

Much difference is found in the size and roughness of the spores in sporangia from the same cultivation. In some groups they measure
12 to 15 μ, and are strongly spinulose; while in others they are smoother, and average 9 to 11 μ diam. The lime-granules in the sporangium-wall frequently coalesce into vitreous superficial scales or coarse particles, and those in the lime-knots become transparent and lose their granular character. This feature is occasionally, though rarely, met with in other species. In preparations in water of highly calcareous sporangia part of the lime is found to dissolve, and on drying to crystallise on the slide in particles resembling those described. A cultivation from an extensive growth of plasmodium exhibited the forms α, β, and γ in the development of the sporangia.

a. Sporangia ovoid or reniform, laterally compressed, on short black or grey stalks, or sessile.

β. Sporangia ovoid or reniform, on white stalks 0·5 mm. long.

γ. Plasmodiocarps lobed and confluent.

δ. Sporangia subglobose, stipitate.

Plate XVI., A.—a. sporangia of vars. α, β, and γ, developed from the same plasmodium, × 20; b. capillitium and spores, × 280; c. spore, × 600 (England).

B.—a. sporangia of vars. α and γ, drawn from the type specimen of Physarum Phillipsii, × 20; b. capillitium and spores, × 280 (England); c. sporangia of var. δ, × 20; d. capillitium and spores, × 280; e. spores, × 600 (Iowa, B.M. 807).

Plate XVII., A.—a. sporangia from type of P. nicaraguense Mach., × 20; b. capillitium and spores, × 280; c. spore, × 600 (Nicaragua).

The specimens named P. nephroidesum Rost. (Strassb. Herb.) are the form α. The type of P. candidum Rost., from Juan Fernandez (K. 510), is the form β; in some of the sporangia the lime-knots coalesce to form a central mass; that of P. Phillipsii Balf., from Phillips' Herb., shows the forms α and γ; and that of P. lividum var. conglobatum Rost., from Ceylon, No. 55 (K. 1244), is the form α with short black stalks; that of P. affine Rost., from Cuba, No. 907 (K. 1350), is the form β with white stalks. Didymium botryoides Berk. in Herb., from New Zealand (K. 1523)—a type of D. radiatum Mass.—is the form α. D. pruinosum Berk. & Curt., from Cuba (K. 1515), given by Rostafinski as a synonym for P. nephroidesum (Rost., App., p. 5), is the form α. P. glaucum Phill., in Phillips' Herb., is form α both with short black stalks and sessile. In Berkeley's Herb, there are two gatherings from Ceylon of one species under the name of P. mutans: one of these (K. 1406) is the type of Tilmadoche reniformis Mass., the other (K. 1407) the type of Didymium echinospora Mass. It is a form with compressed reniform sporangia on long buff stalks; capillitium with large fusiform or branching lime-knots and short connecting hyaline threads; spores dark purple-brown, spinose, 13 to 15 μ. It appears to be a variety of P. compressum, form α, differing from the type in the long slender stalk.

American specimens, with nearly globose sporangia, and buff or white, long or short, stout stalks, from Professors Farlow and Macbride, appear from the capillitium and spores to be P. compressum, but a well-marked variety. They are more symmetrical than European forms, and are distinguished as var. δ.

The specimen from Nicaragua named P. nicaraguense Macbride (figured on Plate XVII., A.) corresponds with a long-stalked and lobed form of P. compressum from Ceylon (B. M. 420), part of which gathering is shortly stalked or sessile; it also approaches a specimen from Luton (I.B.M.30), in which the lobed and confluent sporangia
are seated on short white stalks. The abundant lime in the capillitium and pseudo-columella are varying characters, but are unusually pronounced in this specimen. The spores are purplish-brown, minutely and closely spinulose, 9 to 10 \( \mu \) diam. Prof. Macbride compares it with \textit{P. glaucum} Phill., a synonym for \textit{P. compressum}, and there does not appear to be any specific character by which it can be separated from that species.

\textit{Hab.} On dead wood, etc.—Shrewsbury (B. M. 115); Hitchin, Herts. (L:B.M.30); Linlithgowshire (K. 1499); Germany and Poland (Strassb. Herb.); Italy (B. M. 425); Ceylon (B. M. 419, 420); Australia (K. 1314); New Zealand (K. 1282); \& New Hampshire (L:B.M.30); \& Iowa (B. M. 806); Texas (K. 1303); Cuba (K. 1350); Juan Fernandez (K. 510); Paraguay (Paris Herb.); Nicaragua (B. M. 1010).

22. \textit{P. didermoides} Rost., Mon., p. 97, fig. 87 (1875). Plasmodium? Total height 0·5 to 1·3 mm. Sporangia ovoid, erect, stipitate or sessile, crowded, about 0·8 mm. high, 0·5 mm. broad, white, or dark grey above from the falling away or discontinuance of the outer calcareous crust; sporangium-wall of three layers, the outer a dense deposit of white lime-granules, deciduous, the middle layer a delicate colourless membrane with scattered lime-granules, closely combined with an inner purplish, hyaline, arched, thicker layer. Stalk variable in length and thickness, or wanting, white, membranous, with innate deposits of lime-granules, not containing refuse matter, rising from a plicate white hypothallus. Columella none. Capillitium consisting of numerous rounded or somewhat angular white lime-knots connected by short, seldom branching, hyaline threads, which are purple at the attachments to the sporangium-wall. Spores very dark purple-brown, nearly smooth or minutely spinulose, 10 to 13 \( \mu \) diam.—Cooke, Myx., p. 11; Mass., Mon., p. 291; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 154. \textit{Spumaria didermoides} Pers., Syn. Addenda, p. xxix (1801). \textit{Physarum lividum} \( \beta \) \textit{licheniforme} Rost., Mon., p. 95; Mass., Mon., p. 304 (in part) \textit{Physarum cinereum} var. \textit{ooides} Sacc., in Michelia, ii., p. 334; Sacc., Syll., vii., p. 344; Mass., Mon., p. 299.

Plate XIX., A.—\( a \) sporangia, \( \times 20 \); \( b \) capillitium, with fragment of sporangium-wall and spores, \( \times 280 \); \( c \) spore, \( \times 600 \) (Italy).

\textit{P. cinereum} var. \textit{ooides} Sacc. on \textit{Ailanthus glandulosa} (B. M. 432) is a short-stalked form of \textit{P. didermoides}, the sporangia arising from a white membranous hypothallus. \textit{P. lividum} var. \textit{licheniforme} Rost., parts of the type of which from Schweinitz’ Herb. are in the Strassburg and Kew collections (K. 1249), is a sessile form of \textit{P. didermoides}.

\textit{Hab.} On dead wood, leaves, etc.—King’s Cliff, Norths, (K. 1252); Lyons, France (B. M. 432); Germany (Paris Herb.); Italy (K. 101); Natal (K. 8); Ceylon (B. M. 420); Iowa (B. M. 809); N. Carolina (B. M. 998); Ohio (L:B.M.31).

23. \textit{P. cinereum} Pers., in Römer, N. Mag. Bot., i., p. 89 (1794). Plasmodium watery white, among dead leaves. Sporangia sessile, subglobose, pulvinate, oblong or plasmodiocarps, scattered or crowded, contorted and confluent, 0·3 to 0·5 mm. broad, white or cinereous, more or less warted or veined; sporangium-wall

Plate XVIII., A.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (England).
Plate XVIII., B.—a. sporangia, × 20; b. capillitium attached to columella and spores, × 280; c. spore, × 600 (Germany, Rostafinski’s type of Crateriachea mutabilis).

The capillitium of P. cinereum varies widely in the development of the lime-knots; in the common forms they are very numerous and rounded. Sometimes they are large and angled, and at other times small with the hyaline threads profuse. They are usually equally distributed among the capillitium, but occasionally more concentrated in the middle of the sporangium. A remarkable instance of the latter state is seen in the form named by Rostafinski Crateriachea mutabilis (Mon., p. 126), the type of which is in the Strassburg collection. Here the lime-knots are confluent, forming a distinct columella, a few also appearing among the network of hyaline threads by which it is surrounded. The sporangia are mostly elongated plasmodiocarps with scanty, brownish-yellow hypothallus, but some are ovoid or subcylindrical, erect on a short brown stalk, the brown colour extending into the lower part of the sporangium-wall. The specimen issued by Rabenhorst and Winter from Pavia No. 2969 (B. M. 542), wrongly named Didymium squamulosum, resembles Crateriachea in the sporangia being occasionally provided with a short brown stalk, and in the lime-knots being confluent and forming a pseudo-columella, but they are less densely compacted and more distributed among the surrounding capillitium; the sporangia are also nearly globose. In the form named by Cesati Didymium Neapolitanum (B. M. 573),* the lime-knots are confluent, forming a large central mass more or less attached to the base of the sporangium; the surrounding capillitium either consists almost exclusively of hyaline threads, or has a few large scattered lime-knots in addition; the sporangia are irregularly globose, sessile, or on a buff foot-like hypothallus; the spores in these three specimens are the same as in P. cinereum. How far Crateriachea mutabilis, Didymium Neapolitanum, and the Pavia specimen above mentioned may be held to be varieties of P. cinereum, or as distinct species, must depend on further gatherings establishing the constancy of their forms; as the occasional aggregation of lime-knots is of frequent occurrence in other species of Physarum, and in the somewhat nearly allied Badhamia panicua, this character can scarcely be considered important. It appears from

* Two species were issued by Rabenhorst and Winter under the name Didymium Neapolitanum Ces., No. 2675; that in the Kew coll. (557) is D. squamulosum, that in the British Museum (573) is the species above described.
Berkeley’s description of *Didymium scrobiculatum* that Rostafinski was right in placing it under *P. cinereum*. There is nothing remaining of the type specimen in Berkeley’s Herb. (K. 1518).

_Hab._ On dead leaves, etc.—Lyme Regis, Dorset (L:B.M.32); Leytonstone, Essex (L:B.M.32); France (Paris Herb.); Germany (Strasb. Herb.); Natal (K. 2); Ceylon (K. 1284); Madras (K. 17); Pennsylvania (L:B.M.32); Iowa (L:B.M.32); S. Carolina (B. M. 428, 431, 885, 934); Cuba (B. M. 429); Paraguay (K. 562).


Plate XIX., _a._ sporangium, × 20; _b._ capillitium with fragment of sporangium-wall and spores, × 280; _c._ spore, × 600 (England).

Forms without lime occur occasionally in *P. bivalve* and the allied species.

_Hab._ On dead leaves, etc.—Portbury, near Bristol (B. M. 116, 117); Leytonstone, Essex (L:B.M.33); Luton, Beds. (L:B.M.33); France (K. 28); Germany (B. M. 510); Finland (B. M. 450); Bohemia (B. M. 446); Poland (Strasb. Herb.); Italy (K. 1345); Ceylon (B. M. 451); Java (K. 1312); Brisbane (B. M. 535); Iowa (B. M. 811); S. Carolina (B. M. 932, 933, 934).

25. *P. Didyma* Rost., Mon., p. 110 (1875). Plasmodium white. Sporangia subglobose, 0·6 to 0·8 mm. diam., sessile; or curved and flexuose plasmodiocarps 2 to 6 mm. long, rounded, not compressed, smooth, white or buff; sporangium-wall double, the outer wall densely charged with white lime-granules, free and deciduous above, recurved and persistent below; inner wall smooth, membranous, persistent, of two layers, the outer thin and colourless, combined with the purplish inner layer. Columella none. Capillitium a network of hyaline threads, with numerous, variously shaped large white lime-knots. Spores dark purplish-brown, spinulose, 10 to 12 μ diam.—Mass., Mon., p. 304; List., in Journ. Bot. 1891, p. 260, Pl. 309, fig. 2.

Plate XXII., _a._ sporangia, × 20; _b._ capillitium with fragment of sporangium and spores, × 280; _c._ spore, × 600 (England).
The uncompressed sporangia with the outer wall nearly free from the smooth purplish inner wall characterises this species, and distinguishes it from *P. bivalve* and *P. compressum*, its nearest allies.

*Hab.* On dead leaves, etc.—Wanstead, Essex (L:B.M.34); Flitwick, Beds. (L:B.M.34); Germany (B. M. 512).


Plate XX., A.—*a.* sporangia of two forms, × 20; *b.* capillitium and spores, × 280; *c.* spore, × 600 (Germany: Rostafinski's type).

The type of *Diderma ochroleucum* Berk. & Curt., from Pennsylvania (K. 1533), is typical *P. contextum*.

*Hab.* On dead leaves, sticks, etc.—Lyme Regis, Dorset (L:B.M.35); near Birmingham (L:B.M.35); France (K. 365); Germany (B. M. 418); Sweden (K. 1277); Poland (Strassb. Herb.); Iowa (B. M. 808); Mass., U.S.A. (L:B.M.35).

27. *P. conglomeratum* Rost., Mon., p. 108, figs. 73, 79, 90 (1875). Plasmodium? Sporangia subglobose, sessile on a broad base, densely aggregated on one plane, angled by mutual pressure, 0·3 to 0·5 mm. broad, yellow or brownish-white, mottled with paler shades; sporangium-wall double, the inner layer of the convex upper wall having translucent, pale yellow, curved, thickened areas, with a vitreous fracture; the outer layer thick, consisting of easily crumbling yellow lime-granules; the wall below thin with the two layers less distinct. Capillitium of delicate branching hyaline threads, with numerous white or yellowish, branching, often confluent lime-knots. Spores pale violet-brown, almost smooth, 8 to 10 μ diam.—List., in Journ. Bot. 1891, p. 259, Pl. cccviii., fig. 1. *Diderma conglomeratum* Fr., Syst. Myc., iii., p. 111 (1829). *Physarum Rostafinskii* Mass., Mon., p. 301.

Plate XX., B.—*a.* sporangia, × 20; *b.* capillitium, with fragment of sporangium-wall, showing vitreous structure (*b*) and spores, × 280; *c.* spore, × 600 (Germany: Rostafinski's type).

Distinguished from *P. contextum* by the pale, nearly smooth, and smaller spores, and by the vitreous structure of the inner wall of the upper part of the sporangium. Rostafinski's type specimens of *P. conglomeratum* from Germany (Strassb. Herb.) and from Sikkim.
(B. M. 416; K. 96) correspond with the description in his Monograph, but in both of them the lime-knots, though somewhat confluent in the centre of the sporangium, cannot be said to form a cylindrical columella, such as he describes. The specimen from Fries (K. 1277) taken as the type of this species by Massee (Mon., p. 304) is typical P. contextum in all the characters given by Rostafinski. The name P. Rostafinski, which is given by Massee as superseding P. conglomeratum Rost., is unnecessary. The vitreous structure of the inner wall of the upper part of the sporangium is constant in all the specimens I have examined. Fries distinguished Didemnium conglomeratum from D. contextum chiefly by the difference of the capitellum; he describes the presence of a columella in both species, but speaks of the deposits of lime as being more largely developed in D. conglomeratum. This is an uncertain character, and varies in different gatherings. Rostafinski was the first to detect the main specific difference, and pointed out that in Physarum contextum the spores are rough and measure 10 to 13 μ, while in P. conglomeratum they are nearly smooth and measure 8 to 9 μ diam. He follows Fries in referring to a columella in P. conglomeratum, but adds that it is free and not always evident, and he describes P. contextum as being usually without a columella.

Hab. On dead leaves, moss, etc.—Darenth, Kent (B. M. 417); Hutton, Yorks. (L:B:M.36); Germany (B. M. 415); Sikkim, India (B. M. 416).


a. genuinum: sporangia irregularly ovoid, 0·2 to 0·3 mm. broad, in dense clusters of 20 to 30, on a membranous hypothallus, shading from pale yellow-green to orange-yellow; sporangium-wall with dense innate clusters of yellow lime-granules. Capillitium often scanty. Spores 7 to 10 μ diam.

β. obscurum: sporangia subglobose, 0·4 to 0·6 mm. diameter, sessile, solitary, confluent, or plasmodioarps, gregarious or crowded, smooth or rugose, greenish, grey, or olive-brown and somewhat glossy; sporangium-wall membranous, colourless above, yellow at the base, without lime, or with widely scattered innate clusters of whitish lime-granules. Spores 6 to 8 μ diam.

γ. nitens: sporangia subglobose, 0·5 to 0·8 mm. diam., sessile, gregarious, not clustered, bright yellow. Spores 7 to 9 μ diam.
Plate XXI., A.—a. sporangia, var. a, × 20; b. capillitium, with fragment of sporangium-wall showing calcareous discs, and spores, × 280; c. spore, × 600 (England).
B.—a. sporangia, var. β, × 20; b. capillitium and spores, × 280 (England).

Glycerine mountings of a. genuinum show, dispersed in the sporangium-wall, flattened disc-shaped crystalline bodies with a radiating structure, measuring 10 to 20 μ diameter, such as are also found in the sporangium-wall of P. psittaciacum and Craterium leucocephalum. They do not appear to be present in var. β and γ of P. virescens. Didymium terrigenum Berk. & Curt., from Carolina (B. M. 575), is given by Rost. as a synonym for Physarum cinereum Rost., Mon., App., p. 9. The specimen is in a poor condition, but the character of the sporangia and spores and the orange-yellow lime-knots places it under P. virescens. The specimen from Iowa (B. M. 1011), to which Prof. Maebride applied the name P. aurisalpium Cooke (l.c.), is P. virescens γ nitens.


Plate XXII., B.—a. sporangia, × 20; b. capillitium with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (8. Carolina : Berkeley’s type of D. lateritium).

Intermediate between P. rubiginosum and P. virescens; from orange forms of the latter it differs in the scattered habit of its sporangia, and from both species in the curious structure of the rounded lime-knots.

Hab. On dead leaves, wood, etc.—Ceylon (B. M. 414); Georgia, U.S.A. (B. M. 898); S. Carolina (B. M. 898, 899); Philadelphia (L:B.M.38); Ohio (L:B.M.38).

30. P. rubiginosum Fries, Symb. Gast., p. 21 (1817). Plasmodium? Sporangia subglobose, 0·5 to 0·8 mm. diam., sessile, gregarious or crowded, smooth or rather rough, orange or deep
red or reddish-brown. Sporangium-wall membranous, with dense innate clusters of orange lime-granules. Columella none. Capillitium a network of hyaline threads with frequent triangular membranous expansions at the axils of the branches; lime-knots angular, branching, often confluent, orange-red or orange-brown. Spores pale violet-brown, spinulose, 8 to 11 μ diam.—Rost., Mon., p. 104; List., in Journ. Bot. 1891, p. 259, Pl. 308, fig. 2; Mass., Mon., p. 302; Blytt, Bidr. Norg., Sop. iii., p. 4.

Plate XXIII., A.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (Germany: Rostafinski’s type).

B.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (S. Carolina: Cooke’s type of P. auriscalpium).

The specimen sent by Mr. Wingate to Mr. Massee under the name Leocarpus squamulosus (L.:B.M.38) so closely resembles P. rubiginosum that it appears to be an American form of that species; it agrees with the Strassburg type in the capillitium and spores, and differs only in the more glossy sporangia, which are brown in colour instead of deep red. Two other specimens are difficult to locate. One from Dr. Harkness, Blue Cañon, California (L.:B.M.38), named in Phillips’s coll. Badhamia inaurata, has subglobose sporangia 1 to 1.3 mm. diam.; the sporangium-wall is scaly, and pale yellow with a faint reddish tinge; the capillitium is a network of hyaline threads, with abundant large, branching, pale yellow lime-knots; the spores measure 8 to 10 μ diam.

The other from Aiken, S. Carolina, named in Ravenel’s collection Cienkowskia reticulata (B. M. 991), is a deep orange branching plasmodio-carp; capillitium a network of hyaline threads, with large, branching, pale yellow lime-knots; spores 7 to 9 μ diam. This specimen has a strong external resemblance to Cienkowskia reticulata, but it has not the rigid yellow hyaline capillitium threads with hooked branchlets and the flat lime-plates of that species. Should further gatherings confirm the characters of these two specimens they might deserve specific rank, but at present they are retained under P. rubiginosum, to which, notwithstanding the pale colour of the lime-knots, they appear to be most nearly allied.

The specimen B. M. 863 is part of the type of Physarum auriscalpium Cooke; another part is in the Kew Herb. It is numbered 1854 in Ravenel’s collection from the Santee Canal, South Carolina, and was described in Myx. U.S.A., Ann. Lyc. N. H. New York, vol. xi. (1877), p. 384. It presents the following characters:—Sporangia sessile, or with an almost obsolete stalk; subglobose depressed, gregarious, orange red; sporangium-wall of two layers, the outer densely charged with orange lime-granules and separating in scales from the membranous grey inner layer; columella none; capillitium of large, branching orange lime-knots, with few connecting hyaline threads. Spores dull violet brown, minutely warted, 10 to 12 μ diam. The specimen represents a single gathering, and the point in which it differs chiefly from Physarum rubiginosum Fries is the Badhamia-like capillitium, but judging from Dr. Cooke’s description it would appear that in the sporangia examined by him the hyaline threads were sufficiently developed to include the species in the genus Physarum; in other respects there are no characters by which it can be defined as distinct from P. rubiginosum, and, provisionally at least, it appears better to place it as a form of the latter species.
Hab. On dead wood and leaves.—Birmingham (L:B.M.39); Germany (Strassb. Herb.); Norway (Christiana Herb.); Philadelphia (L:B.M.39). S. Carolina (B. M. 863, 991); California (L:B.M.39).

**Species not met with in the quoted collections.**


Hab. On twigs of bramble, ferns, etc.—Sweden.

This description applies to *Craterium citrinellum* List.


Hab. On dead leaves.—Germany and Russia.


Hab. On earth in a hothouse.—Salem, N. America.


Hab. Rare.—Salem, N. America.

35. *P. luteovalve* Schwein., l.c. Sporangia irregularly lobed, convex, more or less confluent, externally of a bright gold colour, somewhat compressed, bivalved. Spores bright yellow.

Hab. On fallen stems.—Carolina.

This might refer to some species of *Perichæna*.

36. *P. polyaedron* Schwein., l.c. Sporangia gregarious or somewhat scattered, rather large, blackish-fuliginous, dull, subhemispherical, exactly pentagonal with straight sides, rugose, at length breaking in a somewhat stellate manner from the persistent lower part. Spores and dense capillitium of the same colour as the sporangia.

Hab. On logs of walnut.—Bethlehem, N. America.

37. *P. caespitosum* Schwein., l.c., p. 258. Sporangia subtipitate or suddenly contracted at the base, clustered or scattered, tur-
binato-ovate, with yellow scales. Capillitium yellow. Spores blackish-brown.

_Hab._ On leaves and stalks of rhododendron.—Bethlehem, N. America.

This description would apply to _P. virescens_ Ditm.

38. **P. Schroeteri** Rost., Mon., p. 419. Sporangia stipitate, hemispherical, flattened, greenish-grey. Stalk thick, conical, dull yellow or golden, shining, continued into a distinct obtuse conical columella. Capillitium of delicate threads, forming a dense network provided with lime-knots. Spores violet, delicately spinulose, 10 to 11 µ diam.

_Hab._ Otterdorf, near Rastatt; Dr. Schroeter.

This description points to a form of _P. citrinum._

39. **P. Famintzini** Rost., Mon., p. 107. Sporangia sessile, minute, crowded, sometimes confluent, dull chestnut, irregularly hemispherical, dehiscing at the apex. Columella none. Capillitium elastic, elongated after dehiscence; the greater part of the knots not developed, a few containing milky yellow lime-granules. Spores pale violet, smooth, 10 µ diam.

_Hab._ On twigs in Poland.

40. **P. capense** Rost., Mon., p. 113, fig. 92. Sporangia irregularly hemispherical or turbinate, sessile, simple, or more often collected in small clusters on a copious hypothallus, greyish-white, wrinkled. Columella none. Capillitium abundant, with few more or less rectangular lime-knots with very long connecting hyaline threads. Spores pale violet, smooth, 11 to 14 µ diam.

_Hab._ On branches.—Cape of Good Hope. Specimen in the Leipsic Museum.

The figure and description apply to a form of _P. cinereum._

41. **P. Braunianum** de Bary, in Rost., Mon., p. 105. Plasmodium yellow; sporangia irregularly globose, small, sessile, simple, or collected in little heaps, brown, 6-5 mm. diam., dull or shining above; sporangium-wall yellowish brown above, dull brown towards the base. Columella none. Capillitium well developed, with small rounded-angular brown lime-knots weakly developed. Spores pale violet, smooth, 10-7 µ diam.

_Hab._ Grundewald, near Berlin.—A. Braun.

The nearest allies of this species seem to be _P. murinum_ and _P. virescens_ var. obscurem.

42. **P. ornatum** Peck, in Rep. N. York Mus., xxxi., p. 40. Sporangia depressed or hemispherical, plane or slightly concave beneath, greenish-cinerous, dotted with small yellow granules, the empty walls whitish. Stem short, black or blackish-brown, generally longitudinally wrinkled when dry. Columella none. Capillitium with numerous yellow knot-like thickenings. Spores globose, smooth, violet-brown in the mass, about 10 to 11 µ diam.

_Hab._ Decaying wood.—Albany, U.S.A.

This description applies to the pale form of _P. viride_ Pers.

*Hab.* On the living leaves of *Cornus Canadensis* L.—Adirondack Mts., N.Y.

This description suggests a form of *P. virescens* Ditm.

44. **P. imitans** Racib., in Rozpr., Mat.-Przyr. Akad. Krak., xii., p. 73 (1884), fig. 3 a b. Sporangia hemispherical, umbilicate, greyish-white, erect or nodding, with the stalk 1 mm. high. Stalk a little longer than the sporangia, rigid, subulate, brownish-black. Columella none. Capillitium white, abundant, forming an irregular net; nodes sometimes filled with lime, of various shapes. Spores violet, minutely warted, 9.5 to 10 μ diam.—Sacc., Syll., vol. vii., p. 348.

*Hab.* On branches.—Poland.

Var. **flexuosum** Racib., Hedw., vol. xxviii., p. 120. Plasmodio-arps vermiform. Capillitium of the type of *P. leucophaeum*, from which it differs in the distinctly warted spores.

The spores of *P. leucophaeum* vary in the extent to which they are warted, but are never quite smooth under a magnification of 1200 diam. The description of *P. imitans* applies to that species.

45. **P. chlorinum** Cooke, in Grev., v., p. 101, pl. 86, fig. 10. Sporangia scattered or gregarious, small, sessile, subglobose, greenish-yellow, simple, bursting in a stellate manner. Spores subglobose, black, opaque, 8 to 9 μ diam.

*Hab.* On dead wood of *Cocos nucifera* L.—Demerara.

In the absence of a type specimen, this description is too brief to be serviceable.

**SPECIES REFERRED TO TILMADOCE NOT MET WITH IN THE QUOTED COLLECTIONS.**

46. **T. anomala** Mass., Mon., p. 333. Gregarious; sporangia globose or slightly depressed, minutely umbilicate beneath, white, sprinkled with minute particles of lime; stem elongated, slender, equal, straight, pale yellow, longitudinally wrinkled, filled with particles of lime, expanding at the base into a minute circular hypothallus. Capillitium rather dense; threads everywhere equal, about 3 μ thick, combined to form a loose irregular network. Nodes very rarely slightly incrassated, and containing a few minute, colourless granules of lime; spores globose, dirty lilac, smooth, 10 μ diam.

*Hab.* On wood.—Venezuela.

47. **T. cavipes** Berk., in Grev., xi., p. 39. Mycelium reticulate, white sporangia, when young, flesh-colour, afterwards brick-red,
pulverulent, globose; stalks white, thickened at the base, cottony, hollow; spores purple-black, smooth, globose. Capillitium scanty, yellow.

_Hab._ On leaves of _Phalanopsis._—Andaman Isles.

The filmy reticulate mycelium at length disappears, and the peridia are scattered, looking at first sight, from their white stems, like _Diachaea_. The species is altogether distinct from _Trichia lateritia_ Lev. The dust of the peridia consists of irregular fragments of a bright orange-red.

**SPECIES EXCLUDED FROM THE GENUS.**

- _P. chrysotrichum_ Berk. & Curt. = _Badhamia decipiens_ Berk. & Curt.
- _P. citrinellum_ Peck. = _Craterium citrinellum_ List.
- _P. concinnum_ Mass. = _Badhamia lilacina_ Rost.
- _P. ellipsosporum_ Rost. = _Fuligo ellipsospora_ List.
- _P. gyrosum_ Rost. = _Fuligo septica_ Gmel.
- _P. rufibasis_ Berk. & Br. = _Physarella mirabilis_ Peck.
- _P. scyphoides_ Cooke & Balf. = _Craterium leucocephalum_ Ditm.

The following species of _Physarum_ are rejected by Rostafinski on sufficient grounds (Rost., Mon., p. 304):

- _P. antiades_ Fr.
- _P. atrum_ Fr.
- _P. connatum_ Schum.
- _P. elongatum_ Link.
- _P. fluvo-virens_ A. & S.
- _P. fimetarium_ Schum.
- _P. hypnophilum_ Fr.
- _P. piceum_ Fr.
- _P. purpurascens_ Link.
- _P. stipitatum_ Chev.
- _P. villosum_ Schum.

Genus 4.—**FULIGO** Haller, Hist. Stirp. Helv., iii., p. 110 (1768). Sporangia elongated, branching and interwoven, combined into a pulvinate or effused _æthalium_; the outer layer forming a cortex charged with deposits of lime-granules, without spores; the inner stratum containing the spores and a well-developed capillitium, with few or many lime-knots; the lower layer forming a skin-like hypothallus.
KEY TO THE SPECIES OF FULIGO.

Æthalia and lime-knots yellow or variously coloured:—

Spores nearly smooth, 7 to 10 μ diam. (1) F. septica
Spores spinulose, 10 to 11 μ diam. (2) F. ochracea

Æthalia and lime-knots pure white. (3) F. ellipsoспора

1. F. septica Gmelin, Syst. Nat., p. 1466 (1791). Plasmodium yellow. Æthalia pulvinate, varying much in size, from 2 mm. to 20 cm., broad, yellow, pinkish or dull white or reddish-brown. The sporangia constituting the æthalium are intricately coiled and anastomosing, 2 to 2.5 mm. broad, with air spaces in the intervals which permeate the mass. The cortex is sometimes wanting, when the surface is grey and marked with brain-like convolutions. Sporangium-walls within the æthalium membranous, very fragile, colourless, with scattered deposits of lime-granules. Columella none. Capillitium very variable, a loose network of slender hyaline threads more or less expanded at the axils, with rounded, fusiform, or branching yellow or whitish lime-knots, varying much in size. Spores violet, almost smooth, 6 to 10 μ diam.—Blytt, Bidr. Norg., Sop. iii. (1892), p. 5. 


Plate XXIV., A.—a, a small part of an ecorticate æthalium, nearly resembling the type of Physarum gyrosum Rost., × 20; b, capillitium with fragment of sporangium-wall and spores, × 280; c, spore, × 600 (England); d, capillitium and subellipsoid spores from a corticate æthalium, × 280 (Black Forest, Germany).

Rostafinski’s type specimen of Physarum gyrosum Rost. from Berlin in the Stras-burg collection consists of minute pinkish æthalia of Fuligo septica 2 to 3 mm. broad, without superficial cortex. He quotes Reticularia muscorum Fr. (Syst. Myc., iii., p. 91), as a synonym for P. gyrosum; it appears probable from Fries’ description that his species was also a small ecorticate form of F. septica. In the type specimen of Licea Lindheimeri Berk. from Texas (K. 1648) only the basal part of an æthalium remains; it is an orange form of Fuligo septica with scanty delicate capillitium and violet spores measuring 5 to 7 μ. The type of Physarum cerebrinum Mass., produced in a hot-house at Kew (K. 195), is also a form of F. septica with no cortex developed over the convoluted sporangia; it is found that if the rising plasmodium is protected by a bell-glass from currents of dry air, the outer sporangia develop as well as the inner, and no cortex of barren sporangia is formed.

Hab. On rotten wood, tan, etc.—Common. Leytonstone, Essex; Lyme Regis, Dorset (L:B:M.40); Highgate (B. M. 155); Europe (B. M. 461, 463); South Africa (K. 232); Australia (B. M. 468); New Zealand (K. 201); N. America (B. M. 813).

Plate XXIV., A.—e. capillitium and spores, × 280; f. spore, × 600 (United States).

Very closely allied to *Fuligo septica*, from which it differs in the short hyaline threads of the capillitium and the larger rougher spores.

*Hab.* On rotten wood.—Pennsylvania (L:B.M.41).


Plate XXIV., B.—a. æthalia, × 5; b. æthalium, × 20; c. capillitium and spores, × 280; d. spore, × 600 (United States).

The type specimen of *Badhamia coadnata* Rost. from Cuba in the Strassburg collection is similar to the American specimens of *F. ellipsospora*; the large branching lime-knots are connected by very short hyaline threads. The account given by Zopf of *Æthaliopsis stercoriformis* Zopf (Pilzthiere, p. 150, 1884, syn. *Fuligo stercoriformis* Mass., Mon., p. 342) so well describes *F. ellipsospora* that they appear to be the same species.

*Hab.* On dead leaves, etc.—Iowa (B. M. 810); Ohio (L:B.M. 42); S. Carolina (B. M. 845); Cuba (Strassb. Herb.).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**

4. *F. tatrica* Racib. in Hedw. 1885, p. 169, on decaying trunks in Hungary, is described as differing from *F. septica* in having minutely spinulose spores. This does not constitute a specific distinction, as the spores of *F. septica* vary slightly in roughness, and are seldom quite smooth when magnified 1200 diam.

described as being similar to *F. septica*, but with darker spores (violet-black or almost black), 9-16 μ, average 10 μ; according to Raciborski it is a form of the latter species (see Hedw. 1887, p. 111). The character of the spores appears to place it rather under *F. ochracea*.

Genus 5.—**Cienkowskiia** Rostafinski, Versuch, p. 9 (1873). Sporangium-wall cartilaginous at the base; capillitium a loose network of rigid threads with many free, curved, sharp-pointed branchlets, connected with flat perforated calcareous plates attached at their margins to the sporangium-wall.

1. **C. reticulata** Rost., Versuch, p. 9 (1873). Plasmodium? Sporangia consisting of winding branched cylindrical plasmodiocarps, sometimes forming a net, attached by a narrow basal keel to the substratum; 0-5 mm. diam., yellow-brown with transverse pale ridges, blotched with crimson; sporangium-wall orange-yellow, membranous above, cartilaginous below, marked with the bases of the calcareous plates of the capillitium. Columella none. Capillitium consisting of flexuose, branching, rigid, yellow hyaline threads, irregularly anastomosing, with numerous free sharp-pointed uncinate branchlets, and of lime-deposits in the form of flat, perforated, pale yellow plates disposed transversely to the axis of the sporangium and connected by broad or narrow attachments to the sporangium-wall; occasionally with irregular lime-knots intermixed. Spores clear violet-brown, minutely spinulose, 9 to 11 μ diam.—Rost., Mon., p. 91; Cooke, Myx. Brit., p. 11, fig. 107; Mass., Mon., p. 337. *Physarum reticulatum* Alb. & Schw., Consp. Fung., p. 90 (1805).

Plate XXV., A.—*a.* plasmodiocarp, × 2; *b.* portion of plasmodiocarp, in part broken, and showing the parallel plates of lime among the spores, × 20; *c.* capillitium and spores, × 280; *d.* spore, × 600 (Sibbertoft, England).

*Hab.* On dead wood.—Sibbertoft, Leicestershire (L.B.M.43); France (Edin. Herb.); Germany (Strassb. Herb.); Java (K. 1772).


1. **P. mirabilis** Peck, *l.c.* Plasmodium rich yellow. Total height 3 mm. Sporangia shortly cylindrical, inclined, 0-8 mm. long, 0-6 mm. broad, gregarious, stipitate, perforated by a deep umbilicus, which is continuous with the hollow stem, greenish or reddish-yellow. Sporangium-wall thickened with innate deposits of yellow lime-granules and studded with the bases of the spine-like processes of the capillitium, at length dehiscing round the margin of the cylinder, and recurving in stellate lobes from the wall of the umbilicus, which persists to form a hollow pseudo-columella. Stalk cylindrical, slender, broader at the base, striate,

Plate XXV., B.—a, sporangia, x 20; b, transverse section of same, x 20; c, sporangium after dehiscence and dispersion of spores, x 20; d, capillitium, and calcareous spines arising from the sporangium-wall, x 280; e, spore, x 600 (United States).

The examination of Berkeley’s type specimens of Physarum rufibasis Berk. & Br. from Ceylon, and Trichamphora oblonga Berk. & Curt. from Michener, Pennsylvania, U.S.A., shows that they are the same species, and possess the same characters of sporangium and capillitium as Physarella mirabilis—characters so remarkable that the species well deserves to rank as the type of a distinct genus. Forms occur in imperfect developments with short broad stalks and funnel-shaped sporangia, examples of which are seen in Berkeley’s type specimen of Physarum rufibasis, as well as in American specimens. Tilmadoche hians is described by Rostafinski as having the tube of the stalk hollow and completely traversing the oblong sporangium, and the lime-knots of the capillitium irregularly elongated, taking origin for the most part from the sporangium-wall. He quotes two gatherings only: one, the above-mentioned P. rufibasis Berk. & Br., from Ceylon; the other referred to as follows: “The specimen seen was gathered by Jan Kickx (father) in Flanders, and marked by him Craterium minutum Fr.” (Rost., Mon., p. 425.)

Hab. On dead wood. — Ceylon (L:B.M.44); Java (K. 1312); Borneo (L:B.M.44); Pennsylvania (B. M. 852, 882).

Genus 7.—CRATERIUM Trentepohl, in Roth. Catal. Bot., i., p. 224 (1797). Sporangia stipitate, goblet-shaped, with a lid of thinner substance, or subglobose, rugose; sporangium-wall charged with granules of lime, and cartilaginous at least in the lower part. Capillitium of large lime-knots connected by more or less branching hyaline threads. In the centre of the sporangium the lime-knots are usually larger and confluent, forming a pseudo-columella. Stalk cartilaginous.

KEY TO THE SPECIES OF CRATERIUM.

A. Sporangium-wall smooth, glossy:—

<table>
<thead>
<tr>
<th>Lime-knots white.</th>
<th>Lime-knots brown.</th>
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<tbody>
<tr>
<td>1. C. pendunculatum</td>
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<tr>
<td>2. C. concinnum</td>
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B. Sporangium-wall mealy or rugose:
   Sporangia violet.
   Sporangia brown, powdered with white on the upper part.
   3. C. rubescens

   Sporangia yellow:
   Sporangia ovoid; spores 7 to 9 μ.
   4. C. leucocephalum
   Sporangia globose; spores 10 to 12 μ.
   5. C. mutabile
   6. C. citrinellum

1. C. pedunculatum Trentepohl, in Roth, Catal. Bot., i., p. 224 (1797). Plasmodium rich yellow, amongst dead leaves. Total height 0.7 to 1.5 mm. Sporangia goblet-shaped, stipitate, erect, gregarious, 0.4 to 1.2 mm. high, smooth, pale ochraceous, nut-brown or olive-brown; lid either convex, flat, or depressed below the rim, white or concolorous with the sporangium. Sporangium-wall of two or three layers, the outer cartilaginous, thickened at the rim, translucent below and continued into the translucent stalk, the inner layer densely charged with white lime-granules; lime almost absent in the olive-brown form. Stalk equal, plicate, 0.3 to 0.5 mm. long, varying from dark brown to yellowish, usually darker than the sporangium, rising from a circular hypothallus. Columella represented by a central mass of confluent lime-knots, not always present. Capillitium of large white lime-knots connected by delicate colourless or yellow threads. Spores clear violet-brown, minutely warted, 8 to 9 μ. diam.—Macbride, in Bull. Nat. Hist. Iowa, ii., p. 385. Craterium vulgare Ditm., in Sturm, Deutsch. Fl., Filze, i., p. 17, t. 9 (1813); Rost., Mon., p. 118, figs. 94, 96; Cooke, Myx. Brit., p. 18. C. pyriforme Ditm., l.c., p. 19, t. 10; Rost., Mon., p. 120; Cooke, Myx. Brit., p. 19. Peziza minuta Leers, Fl. Herbo., p. 277 (1775). C. minutum Fr., Syst. Myc., iii., p. 151; Rost., Mon., p. 120; Cooke, Myx., p. 19. C. Erstedtii Rost., Mon., p. 120, fig. 99; Mass., Mon., p. 266. C. Friesii Rost., Mon., p. 122, fig. 105. C. confusum Mass., Mon., p. 263.

Plate XXVI., A.—a. sporangia of various forms, × 20; b. capillitium and spores, × 250; c. spore, × 600 (England).

Observations of the development of sporangia from extensive plasmodia in leaf-heaps and in cultivations show that the varieties in shape and colour described by Rostafinski under the names of C. vulgare, C. pyriforme, C. minutum, and C. Friesii may arise from one source, and no specific characters appear to exist to separate the four forms. In examination of the type specimen of C. Erstedtii in the Strassburg Herbarium no character was observed to distinguish it from C. pedunculatum; the sporangia are pyriform, and yellow brown; no lid remains attached to a sporangium, but it is described as white; the capillitium resembles that met with in most forms of C. pedunculatum; a distinct pseudo-columella is present. The specimens from America are mostly of the type in the Strassburg collection named C. vulgare var. verum (or genuinum). They are of a dark olive colour, somewhat small in size, and without a pseudo-columella. The most frequent form in Europe appears to be the var. confusum in the Strassburg Herb.; it is broader in shape, and yellow-brown. When exposed to
weather the sporangia often lose their colour and become white. *Didierma brunneolum* Phill., from California, Harkness, is allied to this species in the smooth yellow-brown cartilaginous outer sporangium-wall enclosing a densely calcareous inner layer, and in the character of the capillitium. It differs in the sporangia being globose and sessile, in the outer wall being continuous throughout, without a lid of different substance, and in the greater roughness of the spores. It appears to be a single gathering, and if a constant form may constitute a distinct species.

_Hab._ On dead leaves, sticks, etc.—_Lyne Regis, Dorset (L:B.M.45)_; Batheaston, Somerset (B. M. 179 to 183); Raincliffe Wood, Yorkshire (B. M. 1057); France (B. M. 469); Germany (B. M. 473); Italy (K. 257); Sweden (K. 1359); Hungary (K. 1362); Ceylon (B. M. 472); New Zealand (K. 254); Pennsylvania (L:B.M.45); Iowa (L:B.M.45).

2. _C. concinnum_ Rex, in Proc. Acad. Nat. Sc. Phil. 1893, p. 370. Plasmodium? Total height 0·5 to 0·7 mm. Sporangia broadly funnel-shaped or goblet-shaped, stipitate, 0·2 to 0·5 mm. diam., smooth, olive-brown, often paler above, dehiscing by a well-defined convex white lid; sporangium-wall cartilaginous. Stalk brown, 0·1 to 0·2 mm. long, plicate. Columella none. Capillitium of numerous small angular lime-knots, connected by short and sparingly branched hyaline threads. Spores purplish-brown, minutely warted, 8 to 9 μ diam.

Plate XXVI., _a._ sporangia, × 20; _b._ capillitium and spores, with fragment of sporangium-wall, × 280; _d._ spore, × 600 (United States).

This species is nearly allied to the American form of _C. vulgare_, but differs in the smaller size, the brown lime-knots, and the browner spores; it appears to have been found almost exclusively on the burs of chestnut in Fairmount Park, Philadelphia.

_Hab._ Philadelphia (L:B.M.46).


Plate XXVII., _a._ sporangia, × 20; _b._ capillitium and spores, × 280; _c._ spore, × 600 (Paraguay).
The specimen from Paraguay named *Didymium paraguayense* Speg. (B.M. 1002) has rather larger sporangia, and these with the capillitium and spores are of a brighter colour than the type from Louisiana, but in other respects they are identical. This species is closely allied to *Physarum Newtoni* Macbr.

Hod. On leaves.—Louisiana U.S.A. (L:B.M. 47); Paraguay (B. M. 1002.)


Plate XXVII., B.—a. to e. sporangia of various forms, × 20; f. capillitium, with pseudo-columella. × 35; g. sporangium-wall, showing crystalline bodies, and spores, × 280; h. spore, × 600 (England); i. cylindrical sporangium, × 20 (United States); j. sporangium, from type of *Physarum scyphoides*, Cooke & Balf., × 20; k. vertical view of half-empty sporangium from the same gathering, showing pseudo-columella, × 20 (Georgia, U.S.A.).

The yellow crystalline bodies are a marked feature in this species. They are frequently absent from the sporangium-wall, but can be detected in the large lime-knots and in the columella by treating with hydrochloric acid, when they remain after the lime-granules are dis-solved. In the delicate cylindrical sporangia, in which the double layer of the wall can scarcely be distinguished, they are to be found only in the columella, and are sometimes entirely wanting. Those in the wall are either nearly superficial and can easily be detached, or are embedded in its substance; they are usually disc-shaped, measuring 15 to 40 μ diam., with a crenate margin, and marked with lines radiating
from the centre to the circumference. Those in the lime-knots are somewhat globular, and are often in clusters; they vary from 5 μ to about 20 μ diam., and dissolve rapidly in dilute carbolic acid. (Noted in the Kew coll., 1888.—A. L.) Physarum scyphoides Cke. & Balf. appears to be a form of C. leucocephalum; the sporangium-wall (× 560) is veined with yellow, and possesses the colourless pits charged with lime-granules of the type, from which it only differs in the more delicate wall in the upper part, and in the somewhat obovoid shape of some of the sporangia. C. cylindricum Mass. is a form of C. leucocephalum with cylindrical sporangia; and in no other character does it differ from the broader type, with which it is connected by intermediate links. The specimen issued by Fückel as C. mutabile Fr., 1455 Fung. Rhen. Exs. (B. M. 481, K. 300), (C. Fuckelii Mass.), is a subglobose form of C. leucocephalum with the lime in the sporangium-wall almost absent; the spores measure 9 to 10 μ diam., and are minutely spinulose. C. minimum Berk. & Curt. is represented in Ravenel’s collection, B. M. 873, “fide Berkeley.” It is the cylindrical form of C. leucocephalum; the sporangia are rufous below, white and pruinose in the upper part; the capillitium shows a pseudo-columella, and the spores are typical.

Hab. On dead leaves.—Wanstead, Essex (L:B.M.48); Luton, Beds. (L:B.M.48); France (K. 282); Germany (B. M. 471); Austria (B. M. 1058); Sweden (K. 298); Italy (K. 297); Java (Strassb. Herb.); Pennsylvania (L:B.M.48); Ohio (L:B.M.48); Georgia (B. M. 455); Brazil (K. 274).

5. C. mutabile Fries, Syst. Myc., iii., p. 154 (1829), non Symb. Gast. Plasmodium lemon-yellow, among dead leaves. Total height 0·7 to 1 mm. Sporangia ovoid or globose, 0·4 to 0·6 mm. diam., stipitate, erect, gregarious, rugose, without a defined lid, golden yellow or greenish, bright yellow on the summit, breaking up at maturity in the upper part into areolae, or dehiscing almost to the base in stellate lobes; sporangium-wall single, membranous, with deposits of innate yellow lime-granules, which are denser and of a deeper yellow on the summit, somewhat stouter and more persistent at the base, where it is continued into the cartilaginous stalk. Columella represented by a central mass of confluent lime-knots, not always present. Stalk cylindrical, 0·2 to 0·5 mm. long, stout, deeply furrowed, nearly translucent, but charged with lime-granules, orange-red or yellow, arising from a circular hypothallus. Capillitium of irregularly shaped yellow lime-knots, varying much in size, connected by a network of hyaline threads with triangular expansions at the axils of the branches. Spores violet-brown, spinulose, 8 to 9 μ diam.—Wallr., Fl. Crypt. Germ., ii., p. 357. Trichia aurea Schum., En. Pl. Saell., ii., p. 207 (1803). Craterium aureum Rost., Mon., p. 124 (1875); Cooke, Myx. Brit., p. 20; Mass., Mon., p. 269.

Plate XXVIII, A.—a. to d, sporangia of various forms, × 20; e, capillitium and spores, with fragment of sporangium-wall, × 280; f, spore, × 600 (England).

Hab. On dead leaves, etc.—Lyne Regis, Dorset (L:B.M.49); Luton, Beds. (L:B.M.49); Batheaston, Somerset (B. M. 133); Appin,
Scotland (K. 299); France (Paris Herb.); Germany (Strassb. Herb.); Ohio (L:B.M.49); S. Carolina (B. M. 888).

6. *C. citrinellum* Lister. Plasmodium? Sporangia subglobose, 0·6 to 0·8 mm. diam., stipitate, erect, gregarious, rugose, lemon-yellow or ochraceous, tinged with orange at the base; sporangium-wall of two layers, the outer cartilaginous, yellow, rugose from dense innate areolated deposits of lime, easily separating from the colourless membranous inner layer. Columella none. Stalk cylindrical, 0·3 to 0·4 mm. high, stout, plicate, orange-red, translucent. Capillitium a network of colourless hyaline threads, with many large, irregular, and branching white lime-knots. Spores purple-brown, rather strongly spinulose, 10 to 12 μ diam. —*Diderma citrinum* Peck, in Rep. N. York Mus. Nat. Hist., xxii., p. 89 (1869). *Physarum citrinellum* Peck, l.c., xxxi., p. 55 (1879); Mass., Mon., p. 278.

Plate XXVII., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (United States).

Closely allied to *Craterium mutabile* Fries, from which it differs in the stouter structure of the sporangium-wall and in the larger, rougher spores. The type specimen of *Physarum lepidodermoides* Blytt, Bidr. Norg., Sop. iii., p. 4 (1892), from Rollag, Telemarken, on moss, has sub-globose stipitate sporangia, 0·7 to 0·8 mm. diam.; the sporangium-wall breaks up into shining convex pale brown scales, densely charged with deposits of lime; there is no columella; the stalks are 0·5 mm. high, stout, broader at the base, pale yellow-brown, without lime-deposits; the capillitium consists of large irregular pale brown lime-knots connected by branching hyaline threads; the spores are purple-brown, spinulose, 9 to 11 μ diam. This appears to be represented by a single gathering, and to have close affinity with *C. citrinellum*.

*Hab.* On moss.—New York (L:B.M.50). Allied species; *Physarum lepidodermoides*, Norway (L:B.M.50).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**


This description applies to *Hemitrichia rubiformis* List.

**SPECIES EXCLUDED FROM THE GENUS.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Equivalent</th>
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<tr>
<td><em>C. lilacinum</em> Mass.</td>
<td>= Badhamia lilacina Rost.</td>
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</table>
Genus 8.—**LEOCARPUS** Link, in Berl. Ges. Nat. Fr. Mag., iii., p. 25 (1809). Sporangium with two walls, the outer cartilaginous and calcareous, shining; the inner hyaline. Capillitium more or less arranged in two systems, one consisting of a network of rigid hyaline threads, the other of coarse anastomosing branches charged with coloured granules of lime.


Plate XXIX., A.—a. sporangia, × 20; b. capillitium and spores with fragment of sporangium-wall showing the three layers, × 170; c. spore, × 600 (England).

**Hab.** On dead leaves, etc.—Hornsey, Middlesex (B. M. 22); Epping Forest, Essex (L:B.M.51); Leighton Buzzard, Beds, (L:B.M.51); Lyme Regis, Dorset (L:B.M.51); Mortonhall, Edinburgh (B. M. 1061); France (Paris Herb.); Belgium (B. M. 482); Germany (B. M. 1059); Poland (Strassb. Herb.); Bohemia (B. M. 489); Finland (B. M. 492); Tasmania (K. 1300); Mass., U.S.A. (B. M. 493); Iowa (B. M. 818); S. Carolina (B. M. 495).

*Leocarpus ramosus* Fr, Summ. Veg. Scan., p. 450, is excluded by Rostafinski, on the ground of its being probably an immature specimen of *L. vernicosus* (Rost., Mon., p. 306).

Genus 9.—**CHONDRIODERMA** Rostafinski, Versuch, p. 13 (1873). Sporangia sessile or stipitate; sporangium-wall of two layers, the outer either a crust composed of globular lime-granules and usually separating from an inner membranous layer, or cartilaginous, more or less charged with lime, and not separating from the inner layer (except in *C. Sauteri*); capillitium without lime-knots. The genus Chondrioderma embraces two sub-genera, *Euchondrioderma* and *Leangium*, which are connected by intermediate forms.
KEY TO THE SPECIES OF CHONDRIODERMA.

A. Sporangium-wall densely calcareous (*Euchondrioderma*):
   A. Spores reticulated.
      2. *C*. subdictyospermum
   b. Spores not reticulated—
      a. Columella white or pinkish, sporangia white.
         Spores violet-brown, 7 to 11 μ diam.
         1. *C*. *spumarioides*
         Spores dark purplish-brown, 10 to 14 μ diam.
         3. *C*. *globosum*
      b. Columella flesh-coloured, hemispherical or flattened.
         Sporangia subglobose, sessile, pink—
         4. *C*. *testaceum*
         Sporangia disc-shaped, stalked, columella flattened.
         5. *C*. Michelii
         Sporangia forming plasmodiocarps, white.
         6. *C*. *reticulatum*
      c. Columella orange, hemispherical, or hardly evident.
         7. *C*. *niveum*
      d. Columella red-brown, clavate or cylindrical.
         8. *C*. *Lyallii*

B. Sporangium-wall cartilaginous (*Leangium*):
   A. Sporangium-wall white and crystalline on the inner side.
      9. *C*. *Trevelyani*
   b. Sporangium-wall without a crystalline layer—
      a. Spores with widely scattered warts.
         13. *C*. *floriforme*
      b. Spores closely spinulose, warted, or nearly smooth—
         Columella hardly evident, sporangia sessile.
         10. *C*. *Sauteri*
         Columella hemispherical or subglobose; stalk stout, ochraceous.
         11. *C*. *radiatum*
         Columella clavate, white; stalk slender, black.
         12. *C*. *rugosum*
         Columella cylindrical, brown; stalk dark brown.
         14. *C*. *Hookeri*
         Columella stipitate, brown; stalk orange.
         15. *C*. *lucidum*

Sub-genus 1.—*Euchondrioderma*. Sporangia sessile, rarely stipitate; sporangium-wall double, the outer layer a smooth crust composed of globular lime-granules, the inner membranous, more or less separating from the outer layer.

1. *C*. *spumarioides* Rost., Mon., p. 174, figs. 142 to 145, 151 (1875). Plasmodium white, among dead leaves. Sporangia sub-
globose, sessile, crowded, 0.5 to 1 mm. diam., seated usually on a strongly developed white hypothallus, smooth or rugose, white; sporangium-wall of two layers, the outer thick, fragile, composed of globular lime-granules 1 to 2 μ diam., often crumbling away from the membranous, more persistent inner layer, sometimes inseparable. Columella convex or hemispherical, white or pale flesh-coloured. Capillitium of slender, flexuose, purplish threads, branching at an acute angle and somewhat anastomosing. Spores violet-brown, spinulose, 8 to 11 μ diam.—Cooke, Myx. Brit., p. 38. Didymium spumarioides Fr., Symb. Gast., p. 20 (1818); Mass., Mon., p. 232. Physarum stromateum Link, Handb., iii., p. 409 (1833). Chondrioderma stromateum Rost., Mon., App., p. 18. Chondrioderma virgineum Mass., Mon., p. 207.

Plate XXIX., B.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (England).

The type specimen of C. virgineum Mass. (K. 560) is a frequent form of C. spumarioides without hypothallus; the capillitium in some sporangia is normal and without expansions. The type specimen of C. stromateum Rost. in the Strassb. Herb. is from Lochem (leg. Spree, Rab. Fung. Eur., 432); a part of this gathering is in the British Museum (B. M. 515); it does not appear to present any character by which it can be separated from C. spumarioides.

_Hab._ On dead leaves, etc. Common.—Lyme Regis, Dorset (L:B.M.52); France (K. 37); Germany (B. M. 515); New York (B. M. 886); Mass., U.S.A. (L:B.M.52).

2. _C. subdictyospermum_ Rost., Mon., App., p. 16 (1876). Plasmodium? Sporangia subglobose, sessile, crowded, 0.3 to 0.5 mm. diam., snow-white, seated on a well-developed white hypothallus; sporangium-wall thick, fragile, composed of an outer crust of globular lime-granules 2 μ diam., with a delicate, membranous, inseparable inner layer. Columella hemispherical or subglobose, white. Capillitium of somewhat rigid, violet-brown, sparingly branched threads. Spores violet-brown, reticulated with raised ridges or with broken bands, forming a margin about 2 μ broad; 10 to 12 μ diam.—Didymium dealbatum Berk. & Curt., in Herb. Chondrioderma dealbata Mass., Mon., p. 207.

Plate XXX., B.—d. sporangia, × 20; e. capillitium and spores, × 280; f. spore, × 600 (Venezuela, Rostafinski’s type); g. spore, × 600 (Cape).

This species appears to be allied to _C. spumarioides_, differing essentially in the spores. It is represented by two gatherings. One is from Venezuela, named Didymium dealbatum Berk. & Curt. (B. M. 570; K. 1522); this is the type given by Rostafinski (Mon., App., p. 16), and accurately described as having spores provided with protuberances either irregularly disposed or combined into an incomplete net. The other gathering is in the Kew collection (K. 466), named Didymium physaroides, Cape 198; in this specimen the spores are more perfectly reticulated, and, except in colour, resemble those of Trichia favoginea Pers.; the capillitium is also more flexuose.

_Hab._ On moss.—Cape (K. 466); Venezuela (B. M. 570).

Plate XXX., A.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (Poland, Rostafinski’s type).

The capillitium of this species often encloses particles of lime in expansions towards the base of the threads. C. globosum is closely allied to C. spumarioides, differing chiefly in the large and dark spores. Rostafinski’s type specimen of C. globosum from near Warsaw, in Strassb. Herb., has dark spinulose spores 11 to 13 μ diam.; his type specimen of C. affine Rost. from near Warsaw is the same form. C. simulans Rost. is described as differing chiefly from C. globosum in the rough spores, 12-5 μ diam.; as the spores of the type specimen of C. globosum correspond with this definition, C. simulans cannot be considered a separate species.

Hab. On dead leaves, etc.—France (Paris); Strassburg (L: B.M. 54); Poland (Strassb. Herb.); Italy (B. M. 525); Iowa (B. M. 816).


Plate XXX., B.—a. Sporangia, × 20; b. capillitium, with fragment of sporangium-wall, and spores, × 250; c. spore, × 600 (Poland, Rostafinski's type).

The type specimen of Diderma sublateritium Berk. & Br., from Ceylon (K. 1454), is more rufous in colour than is usual in C. testaceum, though not so deep in tone as the specimen from S. Carolina (B. M. 520); the capillitium and spores are typical of this species, of which it is clearly a form.

Hab. On dead leaves.—Flitwick, Beds. (L:B:M.55); Moffat, Scotland (L:B:M.55); France (B. M. 517); Germany (B. M. 516); Poland (Strassb. Herb.); Ceylon (L:B:M.55); New York (L:B:M.55); Ohio (L:B:M.55); S. Carolina (B. M. 520); Cuba (L:B:M.55).

5. C. Michelii Rost., in Fuckel, Symb. Myc., Nachtr. 2, p. 74 (1873). Plasmodium opaque white. Sporangia flat, disc-shaped on a central stalk, rarely sessile on a broad base and confluent, chalk-white, 1 to 1·25 mm. wide; sporangium-wall of two layers on the flat upper surface, the outer a fragile smooth crust composed of globular lime-granules 1 to 3 μ diam., separating from the more persistent membranous inner layer; under surface rugose. Stalk pale ochraceous, 0·5 mm. long, 0·25 mm. thick, furrowed with wrinkles, which are continued over the flat under side of the sporangium; densely calcareous. Columella indefinite, consisting of the broad thickened base of the sporangium, flesh-red or flesh-brown, charged with calcareous deposits in the form of nodules and large rhomboidal granules. Capillitium of colourless delicate threads, variously branched and anastomosing, or of violet-brown threads 1 to 2 μ thick, sparingly branched except at the pale extremities. Spores pale violet-brown, almost smooth, 7 to 9 μ diam.—Mon., p. 172, figs. 131, 146, 149, 150. Cooke, Myx. Brit., p. 37; Mass., Mon., p. 204. Didymium Michelii Lib., Pl. Ardu. Exsic., Fasc. ii., No. 180. Physarum depressum Schum., Enum. Pl. Saell., ii., p. 202 (1803). Diderma depressum Fr., Syst. Myc., iii., p. 108 (?).

Plate XXXI., A.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. capillitium, with stouter and more rigid threads, × 280; d. rhomboidal nodules of lime from stalk, × 280; e. spore, × 600 (England).

Hab. On dead leaves, etc. Common. — Lyme Regis, Dorset (L:B:M.56); Batheaston, Somerset (B. M. 47); Boynton, Yorkshire (B. M. 1112); France (Paris Herb.); Belgium (B. M. 513); Germany (Strassb. Herb.); Sweden (K. 1449); Ceylon (K. 1440); S. Carolina (B. M. 890); Pennsylvania (L:B:M.56).

6. C. reticulatum Rost., Mon., p. 170 (1875). Plasmodium? Sporangia rounded, much depressed, sessile, gregarious, 0·7 mm. diam., or more usually elongated and forming flat branching or net-like plasmodiocarps, smooth, white; sporangium-wall of two layers, the outer a fragile crust of globular lime-granules, separating

Plate XXXI., A.—f. orbiculare and plasmodiocarp sporangia, × 20 (United States).

Rostafinski's type specimen at Strassburg consists of flattened, white, branching or net-like plasmodiocarps, with capillitium and spores as described above. It is a question whether this species should not be placed as a variety of C. Micheli, from which it differs only in the shape of the sporangia. Instances have occurred in which the stalked and plasmodiocarp forms have been found together, with strong evidence that they sprung from the same plasmodium. On the other hand, they are so constant that, for convenience, the name given by Rostafinski is retained in this catalogue for the sessile and plasmodiocarp forms. From plasmodiocarp forms of C. testaceum it is distinguished by the flat sporangia and the absence of any rosy tinge in the sporangium-wall and columella. The Ceylon gatherings, marked "75. Diderma depressum Fr." (B. M. 514; K. 1438, 1439), show flattened white plasmodiocarps, with brownish flesh-coloured columella, and must be referred to C. reticulatum; as also must C. Saundersii Berk. & Br., from Java (K. 1479), in the type specimen of which the broad, extensive plasmodiocarps resemble the American gatherings.

Hab. On dead leaves, sticks, etc.—Luton, Beds. (L:B.M.57); Switzerland (Strassb. Herb.); Ceylon (B. M. 514); Java (K. 1479); Ohio (L:B.M.57); Philadelphia (L:B.M.57); Iowa (B. M. 1022).


a. genuinum: sporangia subglobose, crowded.
β. deplanatum: sporangia forming plasmodiocarps, scattered.

Plate XXXI., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (Vosges Mis.; Rostafinski's type); d. sporangia of form
connecting \textit{a. genuinum} with \textit{b. deplanatum}, \times 2; \textit{c. plasmodiocarp} of the same gathering, \times 20 (Chiselhurst, England, B. M. 27).

Rostafinski’s type specimen of \textit{C. niveum} in Strassb. Herb., from Giromagny, has subglobose, crowded sporangia, with a fragile, eggshell-like outer wall; the inner wall is membranous, more persistent, orange at the base; the columella is orange, sometimes scarcely developed; the capillitium threads are rigid and warded. The specimen in Berkeley’s collection from Linlithgow, named by him \textit{Didierma cyanascens} Fr. and by Rostafinski \textit{C. niveum} (K. 1435), is a plasmodiocarp form, with the lower part of the inner wall and base orange, and the columella depressed; it has the same rigid warded threads as in the Strassburg type. There is no type specimen from Fries of \textit{Didierma deplanatum} in the Strassburg or British collections, but his description (Syst. Myc., iii., p. 110) applies well to Berkeley’s specimen named \textit{D. deplanatum} Fr. from Appin (K. 410), which is accurately described in \textit{English Flora} (l.c.), and is undoubtedly the same species as the Linlithgow specimen of \textit{C. niveum}. The sporangia are branching plasmodiocarps, forming, as Berkeley says, “reticulate masses, the outer wall thick, white, the inner very thin, hyaline”; the columella is only represented by the thickened orange-brown base of the sporangium; the capillitium consists of rather delicate purplish branching threads, with scattered wart-like thickenings; the spores measure 9 \mu. The type of \textit{C. physaroides} Rost., Mon., p. 170 (syn. \textit{Didierma deplanatum} Fr., \textit{Chondrioderma deplanatum} Rost., Mon., App., p. 17) is not represented in the Strassburg or British collections. \textit{Didierma albescens} Phill. closely resembles the Strassburg type of \textit{C. niveum} in its globose, crowded sporangia, with orange-brown inner wall and columella; the capillitium is of rigid warded threads, intermixed with others more slender; the spores are identical with those of Rostafinski’s type, purple-brown, 9 to 11 \mu diam.; it is evidently the same species. The specimen here figured from Chiselhurst, named \textit{D. deplanatum} Fr. by Broome (B. M. 27), connects all these forms; its sporangia are either globose, or elongated plasmodiocarps, with capillitium exactly of the Strassburg type.

\textit{Hub.} On dead leaves, sticks, etc.—Chiselhurst, Kent (B. M. 27); Carlisle (L:B.M.58); Appin, Scotland (K. 410); Linlithgow (K. 1435); Vosges Mts. (Strassb. Herb.); Christiania (L:B.M.58); California (L:B.M.58); Brit. Columbia (K. 379).

8. \textit{C. Lyallii} Mass., Mon., p. 201 (1892). Plasmodium? Sporangia subglobose, sessile or shortly stipitate, aggregated, seated on a more or less strongly developed white hypothallus, 1 to 1.5 mm. diam., nearly smooth, roughened with minute scattered prominences; sporangium-wall of two layers, the outer thick, densely charged with lime-granules, separating from the membranous inner wall, which is firm and usually orange at the base. Stalk short, stout, rugose, white or ochraceous. Columella cylindrical, or clavate and stipitate, ochraceous, sometimes attaining two-thirds the height of the sporangium. Capillitium of rigid dark violet-brown threads, branching and anastomosing, 1.5 to 2 \mu broad. Spores dark violet-brown, spinose, 11 to 15 \mu diam.

Plate XXXII., A.—\textit{a. sporangia}, \times 20; \textit{b. capillitium} with fragment of sporangium-wall and spores, \times 280; \textit{c. spore}, \times 600 (Switzerland).

\textit{Hub.} On dead grass.—Switzerland (L:B.M.59); Oregon Boundary, U.S.A. (K. 380).
Sub-genus 2.—**Leangium.** Sporangia stipitate or sessile; sporangium-wall of two closely connected layers (which do not separate, except in *C. Sauteri*); the outer cartilaginous, more or less charged with innate minute lime-granules; the inner membranous, often dehiscing in revolute lobes from the naked globose mass of spores.

9. **C. Trevelyani** Rost., Mon., p. 182 (1875). **Plasmodium?** Total height 1 to 1·5 mm. Sporangia globose or subellipsoid, sessile or shortly stalked, verrucose or nearly smooth, 1 mm. diam., reddish or orange-brown; sporangium-wall splitting irregularly or in unequal, revolute, petal-like lobes, white on the inner side: of three inseparable layers, the outer one cartilaginous, brown; the inner delicately membranous, attached to the threads of the capillitium; the middle layer thick, composed of coarse irregular crystals of lime. Stalk equal, furrowed, 0·1 to 0·5 mm. high, 0·1 to 0·15 mm. thick, of the colour of the sporangium. Columella none. Capillitium profuse, purple or purplish-brown, somewhat rigid, forming a network with dark bead-like thickenings at the nodes and on the threads, rarely slender, with few thickenings. Spores dark violet-brown, spinulose, 10 to 13 µ diam.—Cooke, Myx. Brit., p. 40; Mass., Mon., p. 202. **Leangium Trevelyani** Grev., Scot. Crypt. Fl., tab. 132 (1825). **Diderma Trevelyani** Fr., Syst. Myc., iii., p. 105. **Chondrioderma** Ørstedtii Rost., Mon., p. 184, figs. 154, 157; Cooke, Myx. Brit., p. 41; Mass., Mon., p. 203. **Diderma geasteroides** Phill., in Grev., v., p. 113. **Chondrioderma geasteroides** Phill., in Mass., Mon., p. 201. **Diderma laciniatum** Phill., l.c., p. 113.

Plate XXXII., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. fragment of sporangium-wall showing the cartilaginous and crystalline layers, × 280; d. spore, × 600 (California; type of **Diderma geasteroides** Phill.); e. sporangium, × 20 (Shrewsbury, England).

The crystalline middle layer of the sporangium-wall separates this from all other species of the *Leangium* group. The type specimen of *C. Trevelyani* described and figured under the name of *Leangium Trevelyani* in Greville's Scottish Crypt. Flor., tab. 132, is in the Edinburgh Herbarium; it is sessile on *Mnium undulatum*, and was gathered by W. C. Trevelyan, Esq., who also sent specimens to Mr. Sowerby. The specimen named **Diderma Trevelyani**, "Sowerby Herb." (K. 1478), is on *Mnium undulatum*, and is no doubt that referred to. Greville speaks of and figures a "very minute columella"; he was evidently mistaken on this point, and Berkeley in describing Trevelyan's gathering states: "I find no trace of a columella; the bottom of the peridium within is perfectly even." Examination of the type in the Edinburgh collection confirms Berkeley's statement. The specimen from Jedburgh (K. 1477) is marked by Rostafinski *Chondrioderma* Ørstedtii, and is given by him as a type of that species (Rost., Mon., App., p. 21); it has the characteristic capillitium and sporangium-wall of Greville's type. These characters are also present in **Diderma geasteroides** Phill. and *D. laciniatum* Phill., from California, in Herb. Phillips. These three specimens are clearly the same species as *C. Trevelyani*. 
Hab. On dead leaves, moss, etc.—Herb. Bloxam (Leicester?) (B. M. 26); Jedburgh, Scotland (K. 1477); Northumberland (Edin. Herb., ex Herb. Grev.; K. 1478, ex Herb. Sowerby).

10. C. Sauteri Rost., Mon., p. 181 (1875). Plasmodium? Sporangia subglobose, depressed, sessile, somewhat aggregated, 0·7 to 1 mm. diam., smooth, pale pinkish-brown; sporangium-wall of two layers, the outer cartilaginous, thin, brittle, shining, more or less charged with innate lime-granules, separating from the membranous inner layer. Columella hardly evident, a rugose thickening of the base of the sporangium; reddish-brown. Capillitium not very abundant, of sparingly branched colourless or pale violet threads, 2 to 4 \( \mu \) broad, persistent at the base. Spores dark violet-brown, spinulose, 10 to 13 \( \mu \) diam.—Mass., Mon., p. 217. C. aculeatum Rex, in Proc. Acad. N. Sc. Phil. 1891, p. 390.

Plate XXXIII., A.—a. sporangia, \( \times 20 \); b. capillitium, with fragments of sporangium-wall, \( \times 280 \); c. spore, \( \times 600 \) (Salzburg, Tyrol).

The specimen in the Strassburg collection named previously "Diderma deplanatum, ex. Herb. Sauter, ad muscos in montibus Salz." appears to be the type given by Rostafinski (Mon., p. 181), and is well described as "of coffee-and-milk colour, the outer wall brittle, separating from the inner, which is membranous and colourless."

The species described by Dr. Rex as C. aculeatum (i.e.) (L:B.M.61) is identical in all its characters with C. Sauteri. The specimen in Greville’s coll. in the Edinburgh Herb. named “Diderma? Appin. Carm.," is the same form and probably part of the same gathering as K. 403, named "Diderma melaleucum Carm.," with a descriptive note stating that it was gathered in Scotland by Capt. Carmichael. It differs from the Salzburg and American gatherings in the rather darker and larger sporangia, and in the broader, almost simple threads of the more scanty capillitium, but it appears to be the same species.

Hab. On dead wood, moss, etc.—Appin, Scotland (K. 403); Salzburg, Tyrol (Strassb. Herb.); Philadelphia (L:B.M.61).

11. C. radiatum Rost., Mon., p. 182, figs. 152, 155, 156, 170 (1875). Plasmodium pale yellow, among dead fir and oak leaves, and stripped bark. Total height 0·7 to 1 mm. Sporangia subglobose, flattened or umbilicate beneath, stalked or sessile, smooth or somewhat wrinkled and rimose, 0·7 to 1·2 mm. diam., pale grey or brownish or reddish-brown, crowded or scattered; sporangium-wall breaking irregularly above, occasionally dehiscing from the naked globose mass of spores in revolute lobes, cartilaginous, obscurely granular, with a membranous inseparable inner layer. Stalk short, 0·2 to 0·5 mm. high, thick, yellowish-brown, charged throughout with white lime-deposits. Columella hemispherical or subglobose, 0·5 mm. diam., densely calcareous. Capillitium abundant, dark violet-brown, radiating from the columella in somewhat rigid threads, sparingly branched except at the colourless extremities, usually roughened with minute wart-like thickenings; rarely pale, delicate, and flexuose. Spores dark violet-brown, closely and minutely spinulose, 9 to 12 \( \mu \) diam.—Cooke, Myx. Brit., p. 40; Blytt, Bidr. Norg., Sop. iii. (1892), p. 6; Mass., Mon.

Plate XXXIII., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (England).

The development of lime varies in different gatherings and often in individuals of the same cluster; instead of the wall being obscurely granular, as is usually the case, it may be loaded with white granules, or these may be partially present, forming a white cap to a dark sporangium, or the sporangia may be dark brown with little or no deposit of lime in the wall. American specimens received from Dr. Rex differ from the European in the colourless flexuose capillitium and the more ovoid columella. *C. roanense* is described as a new species by Dr. Rex (Proc. Acad. N. Sc. Phil., 1893, p. 368); the sporangia are umber-brown, resembling in this respect the dark forms of *C. radiatum* occasionally met with at Lyme Regis, but they are much depressed and almost orbicular in shape; the columella is convex and pale ochraceous; the short stalks are black; the capillitium is colourless, of the same character as in the American specimens of *C. radiatum*; the spores are similar to those of the latter species. It appears to be represented by a single gathering from Roan Mountain, Tennessee, and is allied to *C. radiatum*, as pointed out by Dr. Rex, who adds: "It differs from the other discoidal or orbicular species in the dark chestnut umber colour, its well-marked discoidal columella and jet-black irregular stipe." Until further gatherings are obtained to establish the constancy of the form, *C. roanense* may be regarded as a variety of *C. radiatum*.

_Hab._ On bark, twigs, etc.—Lyme Regis, Dorset (L:B.M.62); Boynton, Yorkshire (B. M. 1063); Poland (Strassb. Herb.); Norway (B. M. 531); Italy (B. M. 532); Virginia (L:B.M.62).

Plasmodium grey. Total height 0·7 to 1 mm. Sporangia subglobose or hemispherical, stipitate, scattered, 0·5 to 0·6 mm. diam., greyish-white, brown at the base, reticulated with wrinkles "which divide the wall into 25 to 30 irregularly polyhedral portions"; sporangium-wall single, papyraceous, with scanty deposits of lime in minute, scattered, angular fragments. Stalk subulate, 0·4 to 0·6 mm. high, furrowed, black. Columella clavate, about half the height of the sporangium, rugose, chalky or yellowish-white. Capillitium of delicate colourless threads, sparingly anastomosing and branching towards the tips. Spores violet-brown, minutely warty, 9 μ diam.

Plate XXXIV., A.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (United States).

This species is, as stated by Dr. Rex, allied to *C. radiatum*; it has been found once in considerable abundance at Cranberry, N. Carolina.

_Hab._ On moss, etc.—N. Carolina (L:B.M.63).

Plate XXXIV., B.—a. sporangia moist and unexpanded, × 20; b. sporangia dry and expanded, × 20; c. capillitium and spores, × 280; d. spore, × 600 (England); c. sporangia expanded and showing clavate columella, × 20 (United States).

The red-brown spores with scattered warts distinguish this species from all forms of C. radiatum.

Hab. In crevices at the base of oak stumps, etc.—Epping Forest, Essex (L:B.M.64); Germany (B. M. 533); Ohio (L:B.M.64); Iowa (B. M. 817); S. Carolina (B. M. 925).

14. C. Hookeri Lister. Plasmodium? Sporangia subglobose, stipitate, erect, gregarious, 1 mm. diam., rufous with a slight iridescent lustre; sporangium-wall of two layers, the outer cartilaginous, purplish-brown, closely combined with the colourless inner layer. Stalk equal from a broader base, furrowed, 0·7 mm. high, purplish-brown, densely charged with lime. Columella cylindrical, obtuse, rugose with the expanded bases of the capillitium, 0·4 mm. high, 0·17 mm. thick, purplish-brown, densely charged with lime. Capillitium of lax branching and anastomosing threads, nearly equal in breadth throughout, 2 μ diam., colourless or pale violet. Spores dark purple-brown, spinose, 13 to 15 μ diam.—Diderma Hookeri Berk., in Fl. Nov. Zel., p. 191 (1855). Lamproderma Hookeri Rost., Mon., App., p. 24. Diachaea Hookeri Mass., Mon., p. 260.

Plate XXXV., A.—a. remains of sporangia, on fern frond, natural size; b. stalk and columella, × 20; c. capillitium, with portion of columella, containing lime-granules, × 280; d. spore, × 600 (New Zealand).

This is represented by a single gathering, and appears to have been in imperfect preservation when first examined by Berkeley. Rostafinski writes that it was in an injured state when seen by him; probably it was then in much the same condition as at the present time. The specimen consists of a considerable number of sporangia on a frond of Hymenophyllum, but little remains beyond the stalks and columella.
with the bases of the sporangium-walls; they had, apparently, been exposed to weather before gathering, as the tangle of capillitium, where any remains, is closely wound about the columella, as if from the effect of rain. From the structure of the sporangium-wall and capillitium Berkeley was clearly right in placing it as a Diderma. The substance of the outer layer is very similar to that of C. Sauteri, and there is a strong resemblance to that species in the large spinose spores and the pale, rather broad threads of the wavy capillitium; it differs in the presence of the stalk and cylindrical columella, which contain dense deposits of lime extending for some distance into the hypothallus.

Hab. On Hymenophyllum.—New Zealand (K. 1559, L: B.M. 65 slide).

15. C. lucidum Cooke, Myx. Brit., p. 42 (1877). Plasmodium? Sporangia subglobose, sessile or occasionally stipitate, scattered, 0.7 mm. diam., bright reddish-yellow, shining, dehiscing in more or less petaloid lobes; sporangium-wall of two layers without deposits of lime, the outer cartilaginous, closely combined with the membranous inner layer. Stalk very short, 1 mm. high, in one instance 3 mm. high, brown, slender. Columella irregularly globose, 0.35 mm. diam., seated on a narrow stalk, rugose and pitted, ochraceous. Capillitium not abundant, of irregular purple-brown threads 2 to 5 μ diam., branching and anastomosing, with wide expansions at the axils. Spores dark purple-brown, closely spinulose, 12 to 14 μ diam.—Mass., Mon., p. 204. Diderma lucidum Berk. & Br., in Ann. Mag. Nat. Hist., ser. 3, vii., p. 380 (1861). Chondrioderma Carmichaelianum, Mass., Mon., p. 202 (in part).

Plate XXXV., A.—a. sporangia, × 20; f. broken sporangium showing stalked columella, from mounting in glycerine, × 20; g. capillitium and spores, × 280; h. spore, × 600 (Trefriw, Wales).

In Berkeley’s description of this species (l.c.) two localities are given: Trefriw, Wales, and Cumberland. Examples of the former gathering are met with in Broome’s coll. (B. M. 25), named “Diderma lucidum,” and in Berkeley’s collection at Kew, named “Diderma Carmichaelianum, ex Herb. Broome” (K. 353). From the irregular character of the capillitium, and the absence of lime-deposits in the sporangium-wall and columella, it is possible that this is not a normal development, but an unusual form of some other known species.

Hab. On moss.—Trefriw, Wales (B. M. 25).

Species not met with in the quoted collections.

16. C. fallax Rost., Mon., p. 171 (1875). Sporangia seated on a common hypothallus, crowded, but not closely compacted, sessile, globose, chalk-white; columella either small flattened or distinct ovate; capillitium fasciculate below, becoming very diffuse above, dull violet; spores dull violet, strongly spinulose, 12 to 14 μ diam.

Hab. Near Salzburg, Tyrol (Sauter).

May not this be a form of C. globosum?

17. C. anomalum Rost., Mon., p. 169. Plasmodiocularps venulose, creeping, very convex, variously contorted, superficially minutely
granular, brown below, colourless above; columella strongly developed, following the windings of the plasmodiocarp, pale brown; capillitium of slender lax colourless threads combined into a dense net; spores nearly smooth 11·6 to 13·8 μ diam.

Hab. Kiew, Russia (Prof. Walza).

The colour of the spores is not given by Rostafinski. Except for the large size of the spores this description applies nearly to C. reticulatum.

18. C physaroides Rost., Mon., p. 170. Sporangia sessile, irregularly rounded, 1 to 3 mm. diam., convex or somewhat depressed, mutually compressed, chalk-white; sporangium-wall densely charged with lime; columella none, or inconspicuous, depressed, dirty ochraceous; capillitium inconspicuous, of delicate slender hyaline threads combined into a net; spores violaceous, with scattered warts, 12·5 μ diam. C. deplanatum Rost., Mon., App., p. 17.

Hab. The specimen described was gathered near Geneva by De Candolle (father and son).

This description does not correspond with that of Didcrma deplanatum Fr., which is given by Rostafinski as a synonym.

19. C. Friesianum Rost., Mon., p. 173. Sporangia sessile, hemispherical, depressed, snow-white from the abundant deposits of lime; when the outer wall has fallen away, ash-grey; columella distinct, lenticular, depressed, yellowish or flesh-coloured; capillitium well-developed, colourless, the threads combined into a net; spores pale violet, smooth, 8 μ diam. Very nearly allied to C. Michelii.

Hab. Muenchau, near Hattenheim (Fuckel).

Sessile forms of C. Michelii agree with this description.

20. C. calcareum Rost., in Fuckel, Symb., Nachtr., p. 74 (1873). Sporangia sessile, depressed, irregularly angled, forming vein-like plasmodiocarps, chalk-white; outer sporangium-wall shell-like, brittle, easily falling away, the inner wall appearing violet-black from the colour of the spores seen through its transparent membrane; columella inconspicuous, depressed, ochre-yellow; capillitium abundant, of dull violet threads branched and forked, combined into a net; spores delicately warted, 9·2 to 11·5 μ diam. Mon., p. 179.

Hab. Glacko (Link), Schendau (Schmidt), Fuckel.

There can be little doubt from the description that this species is a form of Didymium difforme with abundant dark capillitium.

21. C. vaccinum Rost., Mon., p. 180. Sporangia sessile, globose, depressed, the outer wall shell-like, leather-coloured; the inner transparent, iridescent; columella large, distinct, dusky; capillitium of delicate, colourless, simple threads; spores dull brownish violet, warted, 10·8 to 11·6 μ diam. The outer sporangium-wall is
wrinkled and irregularly reticulated, brownish-yellow; the inner colourless; the large columella is filled with crystalline deposits of lime.

_Hab._ On fallen branches of _Opuntia._—Algiers (Durieu).
This description applies to a dark form of _C. testaceum._

22. _C. Stahlrii_ Rost., Mon., p. 185. Sporangia spherical, slightly flattened at the base, either dull, brownish-white, or shining and dull brown; dehiscing either by a round central opening, or by an oblong fissure, or irregularly; stalk brown, shining; columella entirely wanting; capillitium of dull violet threads 1·2 to 2·3 μ thick, at first simple, branching several times towards the tips, but not uniting into a net; spores pale violet, faintly warded, 9·2 μ diam.

_Hab._ Near Strassburg (Dr. Stahl).
This description suggests a form of _C. radiatum_, in which the columella varies in shape and size.

23. _C. leptotrichum_ Racib., in Rozpr. Mat.-Przyr. Akad. Krak., xii., p. 75 (1884). Sporangia vein-like, or irregular, flattened; sporangium-wall simple, covered with small calcareous scales; columella none; capillitium of delicate threads 0·83 μ diam., forming a flaccid dense net, which can easily be drawn out of the plasmodiocarp; spores blackish-brown, 12·5 to 13·2 μ diam., minutely warded.

_Hab._ Near Cracow, Poland.
The scaly wall of this species suggests that it may be a plasmodiocarp form of _Didymium squamulosum._

24. _C. exiguum_ Racib., in Hedw., xxviii., p. 118 (1889). Sporangia minute, stipitate, 0·3 to 0·4 mm. diam., hemispherical, flattened beneath, grey, iridescent; stalk once or twice the height of the sporangium, very slender, furrowed, narrower and curved above, yellow, without deposits of lime; sporangium-wall simple, with little lime, persistent and yellow beneath, hyaline and breaking irregularly above; capillitium of slender hyaline threads 0·4 μ wide, branched and anastomosing, expanded at the axils, but without lime deposits; spores violet, minutely warded, 7 to 8 μ diam. Resembling certain species of _Tilmadoche_, of which it may be a form with little lime.

_Hab._ On bark.—Near Cracow.
The description applies to _Physarum nutans v. violascens._

25. _C. simplex_ Schroeter, Krypt. Fl. Schles., iii., p. 123 (1885). Sporangia globose, somewhat depressed, solitary; sporangium-wall simple, brittle, bright chocolate-brown; columella wanting; capillitium radiating, repeatedly branched, violet; spores violet, smooth, 7 to 9 μ diam.

_Hab._ On old stumps.—Fürstenstein, Silesia.
26. **C. mutabile** Schroeter, *l.c.*, p. 123. Sporangia sessile, irregular in shape, hemispherical, depressed, or curved and elongated 1 to 3 mm. long, 1 mm. broad; sporangium-wall shell-like, brittle, clear greyish-brown; columella strongly developed, following the shape of the plasmodiocarp, bright red-brown; capillitium of slender violet threads, with scattered knot-like thickenings; spores dark violet, spinulose, 11 to 14 μm diam.

*Rhab.* On dead wood.—Oppeln, Silesia.

This description applies to *C. micrum v. deplanatum.*

27. **C. ochraceum** Schroeter, *l.c.*, p. 124. Sporangia sessile, globose, or half-ring shaped, 1 to 2 mm. long, 1 mm. broad, crowded; the outer sporangium-wall ochre-brown, opaque, breaking up irregularly, the inner delicate, colourless; columella wanting; capillitium well-developed, of smooth violet threads 2 to 3 μm diam., branching and combined into a dense net; spores dark violet, faintly warted, 9 to 11 μm diam.

*Rhab.* On liverwort.—Riesengebirge, Silesia.

The description suggests a form of *C. testaceum*.

**SPECIES EXCLUDED FROM THE GENUS.**

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<tr>
<td>C. Cookei Rost.</td>
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<tr>
<td>C. difforme Rost.</td>
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<td>C. pezizoides Rost.</td>
<td>Trichamphora pezizoides Jungh.</td>
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<tr>
<td>C. Zeylanicum Rost.</td>
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1. **T. pezizoides** Jungh., *l.c.* (1838). Plasmodium? Total height 1 to 2·5 mm. Sporangia discoid or saucer-shaped, stipitate, erect or somewhat inclined, scattered, 0·8 to 1·3 mm. broad, 0·2 to 0·4 mm. thick, pale grey; sporangium-wall membranous, with thin innate deposits of lime equally distributed, breaking up into areoles and remaining attached to the capillitium after the dispersion of the spores. Stalk subulate, longitudinally striate, orange-red, translucent. Columella none. Capillitium of branching, anastomosing colourless threads, with broad expansions at the axils and at the attachment to the sporangium-wall, without lime-knots. Spores dull violet-brown, more or less spinulose, 9 to 15 μm diam.—Chondrioderma pezizoides Rost., Mon., p. 424, fig. 122. Physarum Muelleri Berk., M.S. in Herb. Chondrioderma Muelleri

Plate XXXV., B.—a. sporangia, × 20; b. capillitium, with fragment of sporangium-wall and spores, × 280; c. spore, × 600 (Australia).

The fine specimen from Sumatra in the Leyden Herb., covering an area of six inches on a frond of Selaginella stipulata, a part of which, through the kindness of Dr. Boerlage, is in this collection (L:B.M.67), may be taken as a type of this interesting species. From the unique characters of the sporangium and capillitium, it deserves to retain the generic position assigned to it by Junghuhn in describing the original Java specimen. Examination of the scanty remains of that gathering at Strassburg and at Leyden, and of the types of Physarum Muelleri Berk. from Queensland and Ceylon (K. 1433 and 1432), also of Didymium Zeylanicum Berk. & Br. from Ceylon (B. M. 576), and of Didymium australis Mass. from Brisbane (K. 1491), shows that they all possess the characters given above, and are consequently included under T. pezizoidea. The specimen marked Physarum macrocarpum Ces., No. 1458, Fuckel F. Rhen, (B. M. 403), is a part of Rostafinski's type of Badhamia Fuckeliana Rost., of which a fine example is in Strassb. Herb.; it is essentially identical with the Sumatra gathering of T. pezizoidea. The type of Chondrioderma Berkeleyanum Rost. from Tahiti in the Kew collection (K. 1207A), marked in pencil by Berkeley Trichamphora pezizoidea Jungh., differs from Fuckel's gathering only in the darker and more strongly spinose spores; the number of spines on the hemisphere is the same in each; in the Sumatra specimen the spores are intermediate in colour and in the strength of the spines, while in the Brisbane specimen the spores are nearly smooth. This varying character is not sufficient to raise the Tahiti gathering to the rank of a distinct species. A fine growth from Borneo has dark spinose spores 15 μ diam.

_Hab._ On dead wood, leaves, etc.—Germany (B. M. 403); Natal (K. 376); Ceylon (B. M. 576); Java (Strassb. Herb.); Sumatra (L:B.M.67); Borneo (L:B.M.67); Queensland (L:B.M.67); Tahiti (K. 1207).


**KEY TO THE SPECIES OF DIACHÆA.**

Lime in stalk and columella white.

Spores nearly smooth.

Spores tuberculated.

Lime in stalk and columella orange.

1. _D. elegans_

2. _D. splendens_

3. _D. Thomasii_
1. **Diachæa elegans** Fries, *l.c.* (1825). Plasmodium opaque white. Total height 1 to 1·3 mm. Sporangia cylindrical, obtuse or subglobe, stipitate, erect, gregarious, 0·7 mm. high by 0·25 mm. broad, deep iridescent blue; sporangium-wall membranous, hyaline. Stalk stout, brittle, furrowed, one-third or one-half the height of the sporangium, broad at the base, rising from a well developed hypothallus, densely charged with round lime-granules, 2 to 4 μ diam., snow-white. Columella cylindrical, narrowed upwards, reaching half-way or nearly to the apex of the sporangium, white, densely charged with lime. Capillitm of profusely branched and anastomosing threads connecting the columella with the sporangium-wall, dark violet-brown, colourless at the extremities. Spores dull violet, minutely spinulose, 7 to 9 μ diam. —Fr., *Syst. Myc.*, iii., 156; Berk., in Ann. Mag. Nat. Hist., ser. 1, i., p. 257; Cooke, Handb., p. 395. *Trichia leucopoda* Bull., Champ., p. 121, t 502, fig. 2. *Diachæa leucopoda* Rost., Mon., p. 190, fig. 178; Cooke, Myx. Brit., p. 44; Mass., Mon., p. 259. *D. confusa* Mass., Mon., p. 259. *Didymium bulbillosum* Berk. & Br., in Linn. Journ., xiv., p. 84.

Plate XXXVI., A.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spore, × 600 (England).

The type specimen of *D. confusa* Mass., from Jamaica, does not appear to differ from *D. elegans*; the spores measure 7 to 8 μ, the usual size in that species; they are free except when combined in masses by mould. The type specimen of *Didymium bulbillosum* Berk. & Br., from Ceylon (B. M. 592), is a form of *D. elegans* with globose sporangia; the lime in the stalk is in the form of angular lumps, while the columella is without lime; the spores are more spinulose than in typical *D. elegans*, but not tuberculated as in *D. splendens*.

*Hab.* On dead leaves.—Wanstead, Essex (L:B.M.66); France (Paris Herb.); Germany (B. M. 580); Poland (Strassb. Herb.); Bohemia (B. M. 584); Natal (K. 433); India (B. M. 590); Ceylon (B. M. 592); Ohio (L:B.M.66); S. Carolina (B. M. 848); Cuba (K. 438); Jamaica (Herb. Massée); Chili (Strassb. Herb.); Paraguay (Paris Herb.).


Plate XXXVI., A.—d. sporangia, × 20; e. capillitium and spores, × 280; f. spores, × 600 (United States).

*Hab.* On dead leaves.—Massachusetts, U.S.A. (L:B.M.69); Iowa (L:B.M.69).

3. **D. Thomasii** Rex, in Proc. Acad. N. Sc. Phil. (1892), p. 329. Plasmodium rich yellow. Sporangia globose, shortly stalked or sessile, scattered or crowded on a common orange hypothallus, 0·6 to 0·7 mm. diam., iridescent copper-coloured or violet-blue; sporangium-wall membranous, hyaline. Stalk short, stout, rich orange, densely charged with orange lime-granules. Columella
stout, conical, or shortly cylindrical, densely charged with orange lime-granules. Capillitium radiating from all parts of the columella, composed of rather rigid violet-brown threads, branching and anastomosing, tapering to the hyaline extremities. Spores olive-coloured, marked with small scattered warts, and four to eight prominences, each of which a high magnifying power resolves into a compact cluster of minute warts, 9 to 11 μ diam.

Plate XXXVI., B.—a. sporangia, × 20; b. capillitium and spores, × 280; c. spores, × 600 (North Carolina, U.S.A.); d. sporangia, × 20; e. columella and capillitium, × 50; f. spore, × 600 (Killary, U.S.A.).

The specimen figured (Plate XXXVI., B, d-f) was received from Prof. Farlow, and is part of a gathering by Prof. Thaxter, Killery, U.S.A. The sporangia are sessile, subcylindrical, crowded and somewhat angled by mutual pressure, iridescent, rising from an opaque ochraceous common hypothallus, which extends into a membranous pellicle; the sporangium-wall is persistent, membranous, hyaline or dull purple at the base; the columella is a narrow, membranous, wrinkled tube, dirty ochraceous or brown, reaching nearly to the apex of the sporangium, empty above, with scanty deposits of lime sometimes present in the lower part; the capillitium and spores are as in D. Thomasi. Prof. Farlow has gathered this form more than once, growing in tufts, on moss, always in poor condition, but with the ochraceous hypothallus, narrow columella, and capillitium and spores similar to those in the gathering by Prof. Thaxter. A portion of Prof. Thaxter's specimen was submitted to Dr. Rex, who states that it is the same species as one described by Dr. Sturgis as Comatricha caspíosa n. sp. in Bot. Gazette, xviii., p. 186 (1893). The membranous columella almost free from lime, resembling some Ceylon specimens of D. elegans, and the opaque ochraceous hypothallus, mark the species as distinct from any of the Stemonitaceae; on the other hand, it so closely resembles D. Thomasi that it appears to be a form of that species, though less perfectly developed than the type.

Hab. On bark and moss.—N. Carolina (L:B.M.70).

Species not met with in the quoted collections.

4. D. subsessilis Peck, Rep. N. York Mus. Nat. Hist., xxxi., p. 41. Sporangia gregarious or crowded, subglobose, sessile or with very short white stalks; sporangium-wall delicate, iridescent; columella obsolete; capillitium and spores violet-brown; spores globose, rough, 10 to 12 μ diam.

Hab. On fallen leaves.—Adirondack Mts., N.Y.

The spores of this species, according to Dr. Rex, are marked with diffusely branched rows of minute papillae, ranged side by side in a moniliform manner, and forming either a complete or broken reticulation. (See Rex, in Proc. Acad. N. Sc. Phil., 1893, p. 368.)

Species excluded from the genus.

Order II.—Didymiaee. Deposits of lime in crystals or crystalline discs distributed over the sporangium-wall; capillitium without lime-knots; sporangia simple, except in Spumaría, where they are combined into an æthalium.

KEY TO THE GENERA OF DIDYMIAEE.
Lime-crystals stellate, distributed over the sporangium-wall.

(12) Didymium.

Fig. 20.—Didymium effusum Link.
a. Two sporangia, one entire, the other showing columella and capillitium. Magnified 12 times.
b. Capillitium and fragment of sporangium-wall, with crystals of calcium carbonate and two spores. Magnified 200 times.

Lime-crystals heaped together, at first concealing the confluent hollow sporangia.

(13) Spumaria.

Fig. 21.—Spumaria alba DC.
a. Æthalium. Natural size.
b. Capillitium and fragment of sporangium-wall, with crystals of calcium carbonate and two spores. Magnified 200 times.

Lime-crystals lenticular, marked with radiating striae, scattered over the sporangium-wall.

(14) Lepidoderma.

Fig. 22.—Lepidoderma tigrinum Rost.
a. Sporangium. Magnified 6 times.
b. Capillitium and spores. Magnified 140 times.

Genus 12.—Didymium Schrader, Nov. Gen. Plant., p. 20 (1797). Sporangia stalked, sessile, or plasmodiocarps, not forming an æthalium; sporangium-wall membranous, beset with
superficial crystals of lime either scattered over the surface or combined into a separable crust; capillitium of branching threads, which are often thickened at intervals with dark calyciform nodes, without lime-knots.

KEY TO THE SPECIES OF DIDYMium.

A. Superficial crystals closely combined to form a thin shell-like crust:—
   Capillitium scanty, usually broad at the base.
1. *D. diffforme*
   Capillitium profuse, slender at the extremities.
2. *D. dubium*

B. Superficial crystals scattered or loosely combined:—
   a. Plasmodiocarps, capillitium associated with large, olive-coloured vesicles.
3. *D. Serpula*
   b. Sporangia usually stalked, capillitium without large vesicles—
      a. Sporangia disc-shaped, columella absent. 4. *D. Clavis*
      b. Sporangia subglobose—
         Stalk and columella dark brown, stalk opaque and granular.
4. *D. farinaceum*
         Stalk olive-brown or orange, hornclear.
5. *D. nigripes*
         Stalk and columella white; crystals on sporangium-wall scattered or forming a wrinkled crust.
6. *D. effusum*
         Columella nearly white, stalk when present membranous; crystals on sporangium-wall forming a smooth, thick, deciduous envelope enclosing the pale membranous stalk.
7. *D. crustaceum*

1. *D. diffforme* Duby, Bot. Gall., ii., p. 858 (1830). Plasmodium colourless or pale yellow. Sporangia pulvinate on a broad base or irregularly elongated and forming plasmodiocarps, scattered, 0.4 to 2 mm. or more long, smooth, white; sporangium-wall of two layers, the outer a thin crust of densely combined minute crystals of lime, separating from the iridescent membranous inner layer, which is purplish or nearly colourless above, stout and yellowish-brown at the base, thickened at the margin. Columella none. Capillitium often very scanty, of coarse or delicate, purple or colourless, flattened threads, usually broad at the base, branching dichotomously and slender above. Spores dark purple-brown, faintly warted, 11 to 14 μ diam.—*Diderma diffforme* Pers., Disp. Meth., p. 9 (1797). *Chondrioderma diffforme* Rost., in Fuckel, Symb., Nachtr., p. 73; Mon., p. 177; Cooke, Myx. Brit., p. 39; Lister, in Ann. Bot., vol. iv., No. xiv., p. 282
DIDYMIACE.E.


Plate XXXVII., A.—a. sporangia, × 20; b. capillitium attached to the sporangium-wall, which shows the thickened margin of the base passing into the membranous upper wall, × 280; c. portion of the crystalline crust of lime, × 280; d. delicate capillitium, × 280; e. spore, × 600 (England).

This species is removed from Chondrioderma, where it was placed by Rostafinski, on account of the crystalline character of the lime forming the outer crust of the sporangium-wall. It is to be regretted that there is no type of C. calcareum Rost. in Strassb. Herb., for the description in Rostafinski's Monograph answers well for the forms of D. difforme with well developed capillitium; as the latter species is given by Rostafinski as being almost destitute of capillitium, it is possible that C. calcareum is not entitled to specific rank. The type specimen of Chondrioderma liceoides Rost. (K, 1206) from the Schweinitz Herb., marked Licea macrospora by Schweinitz, is Didymium difforme; the structure of the sporangium-wall and the characters of the capillitium and spores are quite typical.

Hab. On dead leaves and herbaceous stems.—Wanstead, Essex (L.B.M.71); Welshpool, Montgomery (B. M. 1062); France (K. 386); Germany (B. M. 507, 521, 524, 529); Belgium (K. 401); Italy (B. M. 527); India (K. 1466); Seychelles (K. 1467); Carolina (K. 1206),

2. D. dubium Rost., Mon., p. 152 (1875). Plasmodium watery white, among dead leaves. Sporangia rounded or irregular plasmodiocarps, depressed, solitary, 1 to 12 mm. broad, 0·13 mm. thick; sporangium-wall of two layers, the outer consisting of large stellate crystals combined to form a fragile uneven crust, more or less attached to the delicate membranous inner layer. Columella none. Capillitium of profuse, rigid, erect, dark purple-brown threads, anastomosing chiefly above and below, and attached at either end by colourless slender branches to the sporangium-wall. Spores violet-grey, spinulose or nearly smooth, 8 to 15 μ diam.—Cooke, Myx. Brit., fig. 167; Lister, in Journ. Bot. (1891), p. 261; Mass., Mon., p. 246. Didymium Listeri Mass., Mon., p. 244.

Plate XXXVII., B.—a. sporangia, × 20; b, c, d, e. various forms of capillitium, and spores, × 280; f. fragment of sporangium-wall, showing the crystalline outer layer, × 280; g. spore, × 600 (England).

This species is abundant at Lyme Regis, where it presents considerable variation. In many gatherings the spores are nearly smooth, measuring 8 to 10 μ diam., in others spinulose, 12 to 15 μ diam.; the capillitium may differ from the usual form in being flexuose with bead-like or irregular thickenings and with short free branches. Specimens submitted to Rostafinski are pronounced by him to be distinct from the original Hauenstein gathering in having smoother spores and more slender capillitium without thickenings; considering the variation mentioned above, these distinctions cannot be accepted as sufficient to mark the Lyme Regis form as a distinct species.

Hab. On dead leaves.—Lyme Regis, Dorset (L.B.M.72)

Plate XXXVIII., A.—a. plasmodiocarp, × 2; b. section of the same, showing the capillitium and large vesicles, × 80; c. capillitium and spores, × 280; d. spore, × 600 (England).

The drawing of the capillitium in Mr. Massee’s Monograph (fig. 56) does not represent the characteristic vesicles of *D. Serpula*, and the specimens from Kew, Batheaston, and Carlisle quoted by him (p. 234) are plasmodiocarp forms of *D. effusum*, which *D. Serpula* superficially resembles. These vesicles are frequently traversed by the capillitium threads, and are apparently formed later; they are minutely warted, like the spores.

_Hab._ On dead leaves.—Lyme Regis (L:B.M.73); Freiburg, Germany (L:B.M.73); Germany (B. M. 534, Strassb. Herb.); America (L:B.M. 73).


Plate XXXVIII., B.—a. sporangia, × 20; b. capillitium attached above and below to the sporangium-walls, with spores, × 280; c. spore, × 600 (England).

The characters of the type specimen of *D. commutabile* Berk. & Br. (B. M. 537) agree in all respects with those of *D. Clavus*, except that the stalk is 1·5 mm. long, and is encrusted with deposits of lime. The type of *D. neglectum* Mass., from Philadelphia, growing with *Physarella mirabilis* in Herb. Massee, is a slender form of *D. Clavus*; in all
the specimens the upper wall is broken and the spores are shed, but sufficient remains to indicate the discoid form of the sporangia; the sporangium-wall is faintly mottled with brown; the capillitium is delicate, the spores pale violet-brown, 5 to 6 \( \mu \) diam.

Hab. On dead leaves, etc.—Batheaston, Somerset (B. M. 80); Lyme Regis, Dorset (L:B.M.74); Wanstead, Essex (L:B.M.74); Germany (Strassb. Herb.); Ceylon (B. M. 537); Philadelphia (L:B.M.74).

5. D. farinaceum Schrad., Nov. Gen. Pl., p. 26 (1797). Pseudomodium grey, among dead leaves, on bark, etc. Total height 0·5 to 1 mm. Sporangia subglobose or hemispherical, deeply umbilicate beneath, stipitate, gregarious, 0·6 to 1 mm. diam., or nearly sessile and confluent, white or grey; sporangium-wall firm, mottled with purple-brown, beset with stellate crystals of lime. Stalk cylindrical with a broad base, striate, dark brown, rarely rufous, 0·2 to 0·7 mm. long, 0·05 to 0·2 mm. thick, opaque and granular when mounted in glycerine. Columella large, hemispherical, umbilicate, dark brown, chambered, containing coarse granules of lime. Capillitium of stout or delicate, sparingly branched or simple, more or less flexuose threads, colourless or purplish-brown, with dark calyciform thickenings. Spores dark purplish-brown or purplish-grey, with a thick spore-wall, nearly smooth or spinose, 7 to 11 \( \mu \) diam.—Rost., Mon., p. 154; Cooke, Myx. Brit., p. 31; Blytt, Bidr. K. Norg., Sup. ii. (1892), p. 7; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 146; Mass., Mon., p. 219. *Spumaria physaroides* Pers., Syn. Fung., p. 163. *Didymium physaroides* Fr., Symb. Gast., p. 21; Rost., Mon., p. 158; Cooke, Myx. Brit., p. 33; Mass., Mon., p. 233.

\textit{a. genuinum}: threads of capillitium 2 \( \mu \) thick; spores 9 to 11 \( \mu \) diam.

\textit{b. minus}: threads of capillitium 1 \( \mu \) thick; spores 7 to 9 \( \mu \) diam.

Plate XXXIX., A.—\textit{a.} sporangia \textit{a. genuinum}, \( \times 20 \); \textit{b.} capillitium and spores, with fragment of sporangium-wall and lime-crystal, \( \times 280 \); \textit{c.} spore, \( \times 600 \) (England); \textit{d.} sporangia \textit{b. minus}, \( \times 20 \); \textit{e.} the same with heads confluent; \textit{f.} capillitium and spores, \( \times 280 \) (England).

Intermediate varieties uniting vars. \textit{b} and \textit{a} are so frequent that the former cannot be regarded as a distinct species. It is, however, very constant in its characters from different parts of the world, being marked by the smaller size and delicate capillitium. It often bears a considerable resemblance to *D. nigripes*, and is named *D. microcarpum* Rost. in some specimens in Strassb. Herb.; the opaque granular stalk distinguishes it from that species and its allies. Rostafinski's specimen of *D. physaroides* in Strassb. Herb. appears to be an imperfect development of *D. farinaceum*, as indicated by the spores, many of which are abnormal in shape and size, 15 to 50 \( \mu \) long, combined in agglutinated masses, and by the capillitium, which contains vesicular expansions filled with lime-granules such as are not unfrequent in imperfect growths of *Didymium*; the sporangia are mostly clustered and confluent, but in some cases they are solitary; the columella is dark brown and chambered, and the sporangium-wall is mottled with purple-brown.
The specimens K. 471 to 474, called *D. physaroides*, differ in no respect from the common, nearly sessile form of *D. farinaceum*; with a few exceptions the sporangia are confluent at their margins, but confluent sporangia are often met with in *D. farinaceum*.

*Hab.* On dead leaves, bark, etc.—Highgate, London (B. M. 1068); a. and β. Lyme Regis, Dorset (L.B.M.75); a. Ascot, Berks (B. M. 70); a. France (K. 6); a. Germany (B. M. 422); a. Maine, U.S.A. (K. 487); a. and β. Ohio (L.B.M.75); a. S. Carolina (B. M. 889); β. S. Carolina (B. M. 893).


β. *eximium*: stalk dark orange, columella orange or buff.—*D. eximium* Peck, l.c.

γ. *xanthopus*: stalk orange, columella white.—*D. xanthopus* Fr., l.c.

Plate XXXIX., B.—a. small and large sporangia of *a. genuinum*, × 20; b. sporangium of γ. *xanthopus*, × 20; c. sporangium of the same, broken and showing the white columella, × 20; d. capillitium and spores, with fragment of sporangium-wall, × 280; e. coarse capillitium (of less frequent occurrence), × 280; spore, × 600 (England).

Rostafinski's specific name, which he adopted from Fries, was given by this author as a MS. synonym of his *D. nigripes* in Symb. Gast., p. 23, and was never afterwards introduced into his works. Obviously Fries's name must be restored.

The above varieties have been distinguished by specific names, depending on the colour of the stalk, columella, and capillitium. The
capillitium may vary from white to purplish-brown in the same group of sporangia, and the colour of the stalk and columella is also inconstant. The specimen B. M. 885, from Ravenel, S. Carolina, has some sporangia with dark brown and others with deep orange stalks and columella on the same leaf, representing the forms a and β. D. eximium Peck and D. fulvellum Mass. have orange-red stalks, with the columella orange or pale buff. The type of D. proximum Berk. & Curt. (K. 1493) has also orange-red stalks and a buff columella. The type of D. pertusum Berk. (K. 463) has orange stalks and a white columella; it corresponds with the description of D. xanthopus of Fries in all essential characters, for the shape of the columella referred to by Berkeley is a varying feature. D. elegantissimum Mass. (K. 1) is the same variety. These forms blend into one another so completely that they are here united under D. nigripes.

Hab. On dead leaves.—a. Lynton, Devon (L:B.M.76); a. Lyme Regis, Dorset (L:B.M.76); γ. Batheaston, Somerset (B. M. 59, 101); γ. Edinbro’ (K. 440); a. France (Paris Herb.); Germany, a. & γ. (Strassb. Herb.); β. (B. M. 436); a. Switzerland (B. M. 555); γ. Seychelles (Paris Herb.); Ceylon, a. (B. M. 561); β. (B. M. 559); γ. (B. M. 577); γ. Australia (B. M. 562); β. New Jersey (B. M. 566); γ. New York (B. M. 564); S. Caronila, a. & β. (B. M. 884, 885); γ. (B. M. 857); a. Brazil (K. 319); a. Chili (Strassb. Herb.).


Plate XL, A.—a. sporangia, stalked forms, $\times 20$; b. sessile sporangia, one is broken and shows the white columella, $\times 20$; c. plasmodiogarp form without columella, $\times 20$; d. various forms of capillitium and spores, with fragment of sporangium-wall, $\times 280$; e. spore, $\times 600$ (England). The varieties which occur in this common species have led to different forms receiving specific rank. Observations conducted for a length of time on large growths among one heap of leaves show that the colour of the capillitium varies from almost black to colourless in the same locality; a cluster on one leaf may present several shades, and even in a single sporangium one-half of the capillitium may be dark and the other half colourless; this difference of colour is seen in all forms, from the stalked sporangia to effused plasmodiogarps. The stalk and columella may vary from white to bright orange. The characters given as distinguishing D. squamulosum, D. macrospermum, D. discoideum, D. praecox, and D. Fuckelianum are so inconstant that they cannot be applied to mark even varieties of D. effusum. In the specimen of D. effusum Rost. (= D. confluentes Rost., Mon., App., 22), in Strassb. Herb., the sporangia are stalked or sessile, with delicate white capillitium. In the sporangium examined the threads in one portion are without any thickening; in the remaining part there are numerous small fusiform expansions apparently containing lime, as is not infrequent in this species; the spores are minutely spinulose. The specimen of D. macrospermum in Strassb. Herb., has colourless capillitium springing from a large white columella; the spores are strongly spinulose, 10 to 11 $\mu$ diam.; the size of the columella in D. effusum is very variable, and the large development in the Strassburg specimen of D. macrospermum is by no means exceptional; the roughness of the spores is the only feature which deviates from the usual forms of D. effusum, but as the spores of that species vary from nearly smooth to spinose in the same heap of leaves, and present all intermediate degrees of difference, this character cannot be taken as distinctive. D. praecox is described as having two walls; the type specimen at Strassburg is the frequent form of D. effusum, with the crust of crystals on the sporangium-wall wrinkled and scaly, but the wall itself is membranous and single. D. discoideum and D. Fuckelianum are given as distinguished by the coloured stalk, columella, and capillitium, and by the spotted sporangium-wall; these characters are met with in different degrees in sporangia of D. effusum, associated with those having white stalks and those with colourless walls and capillitium. The type of D. radiatum Berk. & Curt. (K. 1516) is nearly destroyed; only the stalks remain, but these are characteristic of D. effusum, being white and spreading at the base, deeply furrowed and granular with deposits of lime; Berkeley's description of the capillitium and spores is not at variance with frequent forms of this species. Chondrioderma Alexandrowiczii Rost., the type specimen of which is in the Strassburg Herb., is probably a form of D. effusum; the sporangia are sessile, with the capillitium and spores of that species; it differs from the type in the almost entire absence of lime. A specimen from Lyme Regis has the sporangium-wall similar to that of the Strassburg specimen; in both cases it is membranous with cloudy spots of brown, and with calcareous deposits in the form of scattered minute spicules; the capillitium in both is violet-brown, beset with short spines, and colourless at the extremities; the columella in both is represented by a brown thickening of the base without
lime deposits; the spores in the Strassburg specimen are minutely roughened with warts on the hemisphere of the usual number observed in *D. effusum*; the points of difference are that in the Strassburg specimen the sporangia are subglobose or of irregular shape, on a broad base, the sporangium-wall crumpled and whitish; in the Lyme Regis specimen the sporangium is a depressed plasmodiocarp, and resembles a *Lamproderma* in the iridescent wall; but it is associated with other sporangia scantily furnished with lime, and also with those of the usual form. *Chondrioderma Cookei* Rost., of which the gathering by Mr. Th. Brittain is represented in Strassb. Herb. and Brit. Mus. (B. M. 137), appears to be another form of *D. effusum*, differing from the type with sessile sporangia in the absence of lime except in minute spicules scattered over the sporangium-wall; the capillitium is an irregular network of dull violet threads, with expansions containing nodules of lime such as are of frequent occurrence in imperfect developments both in this species and its allies; the spores are spinulose, 10 to 12 μ diam.

*Hab.* On dead leaves, etc.; common.—Lyme Regis, Dorset (L:B.M. 77); Batheaston, Somerset (B. M. 37); Sydenham, Surrey (B. M. 1070); Welshpool, Montgomery (B. M.); France (K. 12); Germany (B. M. 530, 550); Austria (B. M. 567); Italy (B. M. 433); Ceylon (B. M. 456); New Zealand (K. 1324); Philadelphia (L:B.M. 77); S. Carolina (K. 89); Cuba (K. 542); Chili (Paris Herb.); Paraguay (Paris Herb.).

8. *D. crustaceum* Fries, Syst. Myc., iii., p. 124 (1829). Plasmodium white, among dead leaves. Sporangia at first globose, confluent, aggregated or scattered, shortly stipitate or sessile, 0·7 to 2 mm. diam., smooth and white from the thick fragile deciduous crust of loosely compacted crystals of lime in which they are enclosed; when the crust has fallen away the sporangia are seen to be grey, and reniform or hemispherical; sporangium-wall membranous, colourless, clothed with large stellate crystals of lime. Stalks pale buff, 0·2 to 0·4 mm. high, membranous, eight or ten often clustered together on an expansion of the membranous hypothallus, at first concealed under the crust of lime enclosing the sporangia. Columella small, irregular, depressed, or not evident in the sessile forms, white or pale buff, charged with coarse granules of lime. Capillitium of colourless or pale violet branching threads 0·5 to 1 μ diam., with numerous minute fusiform thickenings. Spores purplish-grey, strongly spinulose, 10 to 13 μ diam. Rost., Mon., App., p. 22. *D. confluentis* Rost., Mon., p. 164 (non Rost., Mon., App., p. 22); Mass., Mon., p. 235.

Plate XXI., B.—a. sporangia, × 20; b. cluster of sporangia from which the outer crust of lime has fallen away, arising from a common hypothallus, × 20; c. capillitium and spores, × 250; d. crystals of lime from the sporangium-wall, × 280; e. spore, × 600 (England).

Closely allied to *D. effusum*, differing chiefly in the deciduous calcareous envelope of the sporangia, which is often 0·25 mm. thick, and in the membranous stalks. It forms a connecting link between *D. effusum* and *Spumaria alba*.

*Hab.* On dead leaves, etc.—Lyme Regis, Dorset (L:B.M.78); Poland (Strassb. Herb.).
SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.


*Hab.* On rotten birchwood.—Sweden.

Stalks and hypothallus, when present, as in *Trichia rubiformis*, 2 mm. or more in length; sporangia often confluent, blackish, but clothed with delicate grey down; columella none, flocci brown.

The description suggests a mouldy specimen, possibly of *Trichia Botrytis*.

10. *D. versipelle* Fries, Syst. Myc., iii., p. 117. Sporangia lenticular, umbilicate beneath, at first whitish-pruinose, then shining chestnut-brown; stalk conical, rugose, pale yellowish-red; columella brown; spores black.

*Hab.* On dead stalks, etc.; rare.—Sweden.

Stalk 2 mm. long, arising from a vein-like hypothallus; sporangium-wall membranous, at first pruinose, then naked and shining, opening by a longitudinal fissure; columella as in Schrader's figure of *D. tigrinum*, Nov. Gen. Pl., t. 6, fig. 3.

This description applies to *Lepidoderma tigrinum* Rost.


*Hab.* In great abundance in a cucumber frame.—Milton, Norths.

Spreading far and wide in little globose masses; stems reddish-brown, inclining to orange, connate, as if composed of little flat bran-like membranes, sporangia having a greyish tinge from the contained spores, which are purple-black; variegated with the white flocci, which are frequently forked, and vary greatly in width, being in parts flat, broad, and membranous.

This description of the connate sporangia, membranous stalks, and white capillitium applies to some forms of *Badhamia utricularis*, but the colour of the sporangia is against this determination.

12. *D. angulatum* Peck, in Rep. N. York Mus. Nat. His., xxxi., p. 41. Sporangia delicate, subglobose, whitish, clothed with minute granules and crystals of lime; stalk short, whitish; columella subglobose, pale yellowish; capillitium scanty, delicate, white, or slightly coloured; spores irregular, angular, black, 9 to 12 μ.

*Hab.* On dead leaves.—Adirondack Mts., N.Y.

This description applies to specimens of *D. effusum* in which the spores have shrunk.

stipitate; stems mostly connate at the base, tapering upwards, longitudinally wrinkled, white or cream-colour; spores subglobose, black, 10 μ diam.

_Hab._ On decaying fungi.—Portville, U.S.A.

This brief description would apply to connate forms of either _Physarum globuliferum_ or _P. compressum_ var. _δ_; but the shape of the sporangia is against its being reduced to _P. polymorphum_, as is done by Berlese (in _Sacc. Syll._, vii., p. 346).


_Hab._ Hungary.

This description applies to _D. farinaceum_ var. _minus._

15. **D. platypus** Hazslinszky, _l.c._, p. 83 (1877). Sporangia greyish-white, pruinose, scattered, convex above, deeply umbilicate beneath; stalk cylindrical, dilated into a disc at the apex; columella none; capillitium scanty, consisting of black threads combined into a net; spores blackish, smooth, 8 μ diam.

_Hab._ On rotten stalks.—Hungary.

16. **D. affine** Raunk., in Bot. Tidsskrift, xvii., p. 88, t. v., figs. 3 and 4. Sporangia spherical-hemispherical, stipitate. Stem thin, of equal length or longer than the sporangium, expanded into a circular hypothallus at the base, light brown; wall grey under the microscope, after the lime has fallen away colourless. Columella globose or semi-globose, the colour of the stem, or lighter. Threads of the capillitium nearly hyaline, expanded into numerous shortly fusiform, brownish-violet swellings. Spores smooth or delicately warded, 8 to 9 μ diam.

_Hab._ On germinating seeds.—Copenhagen.

This description applies to pale brown stalked forms of _D. effusum._

17. **D. longipes** Mass., Mon., p. 236, fig. 226. Sporangia small, globose, snow-white, frosted with a few scattered granules or crystals of lime; stem very long and slender, erect, snow-white, very slightly attenuated upwards, almost smooth, expanding at the base with a small circular white hypothallus; columella absent; capillitium well developed, threads very thin, colourless, branching and anastomosing irregularly to form a network, nodes usually triangular; spores globose, dingy lilac, smooth, 8 to 10 μ diam.

_Hab._ On bark and wood.—Britain (Yorks); South Carolina.

There is no specimen in Kew Herb. under this name as cited by Mr. Massee.
The following species are excluded by Rostafinski for what appear to be sufficient reasons (see Rost., Mon., p. 229-301):—

D. Linkii Fr.
D. muscicola Link.
D. nanum Fr. & Wein.
D. parietinum Schrad.
D. plicatum Corda.
D. Weinmannii Fr.

D. Sowerbyi Berk., in Sm. Eng. Flora, Fungi, p. 313, must also be excluded, as the description is too imperfect to determine what it is.

**SPECIES EXCLUDED FROM THE GENUS.**

D. australis Mass.  
D. Barteri Mass.  
D. echinospora Mass.  
D. erythrinum Berk. & Curt.  
D. flavicomum Mass.  
D. granuliferum Phill.  
D. obrusseum Berk. & Curt.  
D. paraguayense Speg.  
D. pezizoideum Mass.  
D. sinapinum Cooke.  
D. spumarioides Fr.  
D. tenerrimum Berk. & Curt.  
D. Zeylanicum Berk. & Br.  

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D. sinapinum Cooke.  
D. spumarioides Fr.  
D. tenerrimum Berk. & Curt.  
D. Zeylanicum Berk. & Br.  

Genus 13.—**SPUMARIA** Persoon, Obs. Myc., i., p. 92 (1796). The sporangia are confluent to form an æthalium, otherwise the characters are those of the genus *Didymium*.

1. **S. alba** DC., Fl. Fr., ii., p. 261 (1805). Plasmodium opaque-white, among grass and dead leaves. Æthalia composed of elongated, compressed and folded, lobed and confluent, grey sporangia, arising in more or less loosely compacted clusters from branching processes of the membranous hypothallus, clothed with a thick but fragile and deciduous, white, universal covering of crystals of lime; 2 to 4 c.m. long, 1 to 2 c.m. wide, and about 1 c.m. thick. Sporangium-wall membranous, purplish or colourless. Columella membranous, hollow, compressed, following in its branches the form of the confluent sporangia, sometimes absent. Capillitm a network of widely branching, anastomosing, stout, purplish-brown threads, with numerous dark calyciform thickenings, hyaline at the extremities where they are attached to the sporangium-wall or columella; these are accompanied occasionally with tubular processes of the sporangium-wall, open externally, and either completely perforating the flattened lobes.

Plate XLI., A.—a. aethalium, \( \times 2 \); b. cluster of sporangia from an aethalium; in three places they are broken and show the hollow columelle, \( \times 20 \); c. capillitium and spores, \( \times 280 \); d. crystals from the investing covering of lime, \( \times 280 \); e. spore, \( \times 600 \) (England).

Allied to *Didymium* through *D. crustaceum*, but separated by its aethalial habit.

*Hab.* On grass, dead leaves, etc. Common in Europe. Highgate, Middlesex (B. M. 161); Batheaston, Somerset (B. M. 171); Oxfordshire (B. M. 1083, 1084, 1085); Cromarty, Scotland (B. M. 1088); Ireland (K. 584); France (B. M. 997); Belgium (B. M. 594); Germany (B. M. 599); Finland (B. M. 597); Poland (Strassb. Herb.), Ohio (L.B.M.79); Iowa (L.B.M.79).

The description of *Spumaria Micheneri* Berk., in Grev., vol. ii., p. 52, is too brief in the absence of the type to be of value.

Genus 14.—**Lepidoderma** de Bary, in Rost., Versuch, p. 13 (1873). Sporangia stalked, sessile, or plasmodiocarps; sporangium-wall cartilaginous, beset with superficial crystalline scales; capillitium profuse, without lime.

**KEY TO THE SPECIES OF LEPIDODERMA.**

Sporangia subglobose . . . . *L. tigrinum.*

Sporangia forming plasmodiocarps . *L. Carestianum.*

1. **L. tigrinum** Rost., Versuch., p. 13 (1873).—Plasmodium yellow (*testa* Schröeter). Sporangia subglobose, flattened and umbilicate beneath, stipitate or sessile, scattered, 1 to 1.5 mm. diam., olive- or purplish-grey, glossy, more or less closely beset with rounded or angular crystalline scales of lime, which are sometimes wanting; sporangium-wall cartilaginous, of two closely combined layers, orange-yellow. Stalk stout, cylindrical 0.2 to 0.4 mm. thick, furrowed, orange-brown, of a spongy texture within, containing deposits of lime; rising from a hypothallus which is either vein-like, or effused and of a loose reticulated structure. Columella hemispherical, brown, of the same texture as the stalk, containing deposits of lime in rounded nodules. Capillitium profuse, of straight or flexuose threads, sparingly branched, dark purple-brown or grey. Spores dark purplish-grey, minutely and closely spinulose, 8 to 13 \( \mu \) diam.—Mon., p. 187; Cooke, Myx. Brit., p. 44; Blytt, Bidr. K. Norg., Soph. iii., 1892, p. 7; Mass., Mon., p. 253. *Didymium tigrinum* Schrad., Nov. Gen. Pl., p. 22 (1797). *Lepidoderma fulvum* Mass., Mon., p. 253.

Plate XLI., B.—a. sporangium, \( \times 20 \); b. fragment of sporangium-wall with crystalline discs, \( \times 50 \); c. capillitium and spores, \( \times 280 \); d. spore, \( \times 600 \) (Germany).
The specimen from Ceylon, named by Berkeley Didymium leoninum (K. 1554), which is given by Rostafinski as a synonym for L. tigrinum (Mon., App., p. 23), is immature, the capillitium and spores being undeveloped; the deposits of lime on the cartilaginous, orange sporangium-wall are in the form of large stellate crystals; those in the spongy tissue of the columella are in rounded masses as in typical L. tigrinum. The type specimens of L. fulvum Mass., from Scarboro' (Herb, Mass.), and from Belle Croix, France (K. 1555; Paris Herb.), are immature specimens of L. tigrinum; the spores appear warded under a high magnifying power, though the warts are faint from their unripe condition; the French specimen is part of the large gathering by Roussel, given as a type of L. tigrinum by Rostafinski (Mon., p. 188). Growing with stalked specimens of L. tigrinum, Prof. Farlow has twice found, in Massachusetts, sporangia of a sessile, depressed form, with capillitium and spores exactly as in the type, but with the sporangium-wall of two layers, the outer delicate, ochraceous, densely charged with irregular granules of lime, separating more or less from the inner layer, which is yellow and membranous above, orange and cartilaginous towards the base; the columella is small and depressed. Taken by itself this form would be a Chondrioderma, but considering its association with sporangia of L. tigrinum, from which it differs only in shape, and the granular, not crystalline, condition of the lime on the sporangium-wall, it appears that it is a form of this species.

Hab. On bark, moss, etc.—Leighton, Beds (L:B.M.80); Inverary, Scotland (K. 568); France (K. 1555); Denmark (K. 1557); Germany and Italy (Strassburg); Ceylon (K. 1554); Mass., U.S.A. (L:B.M.80); S. Carolina (Paris).

2. L. Carestianum Rost., Mon., p. 188 (1875). Plasmodium? Sporangia forming elongate, pulvinate plasmodiocarps, 10 to 15 mm. long, 1 mm. thick, brownish-grey, closely beset with white crystalline scales of lime; sporangium-wall cartilaginous, dark brown. Columella hardly evident, represented by the thickened dark brown base of the sporangium-wall, enclosing rounded nodules of lime. Capillitium of colourless, and pale-brown, branching and anastomosing threads, 2 μ thick. Spores dark purplish-grey, minutely spinulose, 12 to 18 μ diam.—Mass., Mon., p. 255. Reticularia Carestiana Rabenh., Fung. Eur., No. 436 (1862).

Plate XLII., B.—e. part of plasmodiocarp, × 20; f. capillitium and spores, × 280 (Italy).

This species appears to be represented by a single gathering, and would seem to be a plasmodiocarp form of L. tigrinum.

Hab. On twigs.—Carestia, North Italy (B. M. 578).

The type specimen of Didymium granuliferum Phillips (Badhamia granulifera Mass., Mon., p. 321) from Dr. Harkness, Blue Cañon, California (L:B.M.78), has the sporangia subglobose or extended, somewhat depressed, sessile on a broad base, 2 to 3 mm. long, gregarious on an effused hypothallus, which, together with the sporangia, is pale brown, and thickly studded with crystalline scales; the sporangium-wall is of two layers, the outer cartilaginous, pale-brown, with deposits of lime in the form of closely set, angular, crystalline
nODULES, separating more or less from the membranous, pale-brown inner layer. The columella is hemispherical or hardly evident, brown, of spongy texture within, densely charged with rounded nodules of lime; the capillitium is a network of pale-brown, hyaline threads, with numerous wide membranous expansions, containing scanty deposits of lime in the form of rounded nodules 20 to 30 μ diam.; the spores are purplish-black, closely spinulose, 15 to 30 μ diam. The cartilaginous sporangium-wall, with its crystalline deposits of lime and the structure of the columella, appears to mark this species, which is represented by a solitary gathering, as a Lepidoderma. Although lime does not occur in well-developed capillitium of the Didymiaeeae, it is occasionally found in nodular deposits in the threads of Didymium squamulosum and D. farinaceum. It is possible, from its presence in the capillitium of Dr. Harkness' gathering, that this is not a perfect development, and this view is supported by the great variety in the size of the spores.

Plate XLII., A.—a. sporangia, × 20; b. capillitium and spores, with fragment of sporangium-wall, × 280 (California).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

3. L. Chailletii Rost., Mon., p. 189, fig. 179. Sporangia hemispherical, adnate on a broad base to the hypothallus or substratum, violet-black, covered with many pearl-like, brown protuberances; columella small, brownish-ochre; capillitium of dull-violet threads forming a dense net; spores dull violet, warted, 10.8 to 12.5 μ diam.

Hab. Switzerland (Chaillet); Hammerstein (Opiz). The columella is composed of fibres forming numerous false chambers filled with crystalline nodules of lime.

This description applies to a sessile form of L. tigrinum.

4. L. obovatum Mass., Mon., p. 254. Sporangia broadly obovate, stipitate; wall dirty ochraceous, thick, studded with large innate patches of lime; stem short, thick, dark brown, wrinkled; columella none; threads of capillitium 3 to 4 μ thick, dingy violet, branching dichotomously with a swelling at the base of each branch, the whole combined into an irregular net; spores dingy violet, minutely warted, 11 to 13 μ diam.

Hab. On grass and twigs.—Sweden; Kew Herb.

I have seen no specimen thus named in Kew Herb. The figures (45—47) are given by Massee in the text of his Monograph as representing this species, but they refer to other species for which they are elsewhere quoted.

The description of L. Kurzii Berk. (Mass., Mon., p. 255), taken from the MS. in Berkeley's Herb., has no mention made of the capillitium, and is too brief to be instructive.

SPECIES EXCLUDED FROM THE GENUS.

Subcohort II.—*AMAUCROCHÆTINÆ*. Sporangia single, or combined into an sathelium, without deposits of lime; capillitium and spores dark-brown or violet-brown, rarely pale.

Order I.—*STEMONITACEÆ*. Sporangia stipitate; sporangium-wall a simple delicate membrane, often evanescent; stalk extending within the sporangium as a columella from which the branching threads of the capillitium take their origin.

KEY TO THE GENERA OF STEMONITACEÆ.

Sporangium-wall evanescent. Capillitium springing from all parts of the elongated columella, ultimate branchlets united to form a superficial net.

(15) *Stemonitis.*

Fig. 23.—*Stemonitis splendens* Rost.

b. Portion of capillitium and columella. Magnified 42 times.

Sporangium-wall evanescent. Capillitium as in *Stemonitis*, but not forming a superficial net, or only imperfectly towards the base of the sporangium.

(16) *Comatricha.*

Fig. 24.—*Comatricha obtusata* Preuss.

b. Sporangium deprived of spores showing the capillitium. Magnified 16 times.

Sporangium-wall evanescent. Columella reaching to the apex of the sporangium, capillitium springing from beneath the superficially expanded end of the columella.

(17) *Enerthenema.*

Fig. 25.—*Enerthenema elegans* Bowm.

a. Group of sporangia. Twice the natural size.
b. Sporangium. Magnified 16 times.
c. Sporangium deprived of spores, showing the capillitium. Magnified 16 times.
Sporangium-wall somewhat persistent, columella about half the height of the sporangium.  

(18) Lamproderma.

Fig. 26.—*Lamproderma irideum* Mass.  
a. Group of sporangia. Magnified 2½ times.  
b. Sporangium deprived of spores, showing capillitium. Magnified 25 times.

Sporangium-wall partly evanescent, persistent in the form of minute discs at the apex of the rigid capillitium threads. Columella short or hardly evident.  

(19) Clastoderma.

Fig. 27.—*Clastoderma Debaryanum* Blytt.  
a. Group of sporangia. Magnified 10 times.  
b. Sporangia deprived of spores, showing capillitium. Magnified 64 times.

Genus 15.—*Stemonitis* Gleditsch, Meth. Fung., p. 140, tab. iv. (1753). Sporangia cylindrical, stipitate, fasciculate; the stalk extending within the sporangium to near the apex as a columella; capillitium formed of numerous threads radiating from all parts of the columella and combined into a loose net-work, the ultimate branches united into a superficial net attached to the evanescent sporangium-wall.

KEY TO THE SPECIES OF *Stemonitis*.

A. Spores grey, violet-grey, or rufous-violet:—

a. Spores spinulose, more or less reticulated, surface net of capillitium with angular meshes.  
   1. *S. fusca*

b. Spores minutely warty, almost smooth, surface net of capillitium with usually rounded meshes—
   Meshes of surface net of capillitium 20 to 100 μ or more wide; sporangia forming on wood.  
   2. *S. splendens*

Meshes of surface net of capillitium less than 20 μ wide; sporangia forming on herbaceous plants.  
   3. *S. herbatica*
B. Spores pale ferruginous:—

Spores 7 to 9 μ diam., plasmodium yellow.

4. *S. ferruginea.*

Spores 4 to 6 μ diam., plasmodium white.

5. *S. Smithii.*


a. *genuina:* spores grey or violet-grey, reticulated, 8 to 10 μ diam.

β. *rufescens:* spores rufous-grey, faintly reticulated, 6 to 8 μ diam.

γ. *confluens:* sporangia confluent, lobed, without stalk, columella, or superficial net.

Plate XLII., B.—a., b. sporangia, a. *genuina,* × 2; c. capillitium, × 180; d. sporangia β. *rufescens,* × 2; e. capillitium, γ. *confluens,* × 180; f. spore, a. *genuina,* × 600; g. spore, β. *rufescens,* × 600; h. three spores from one sporangium uniting the characters of a. and β., × 600 (England); i. three spores from one sporangium (England); k. spore of *S. trechispora* Berk., × 600 (Venezuela).

Plate LXXVII., A.—a. pendulous aethalium, γ. *confluens,* × 20; b. pulvinate aethalium, × 3; c. capillitium of same attached to a fragment of sporangium-wall, × 180; d. spores, × 600 (Epping Forest, England).

The spores of this very abundant species are never smooth, and when magnified 1,200 diam. present the following modifications in sculpture; in a. this either consists of spines, thickened and connected at their bases, forming a complete net with from 20 to 50 meshes on the surface of the hemisphere, and giving a continuous border to the spore; or the spines are less connected, forming a broken net, and giving an irregular border to the spore; or the spines are distinct, arranged on a more or less reticulate plan, giving a spinulose margin to the spore. In β. the sculpture is usually less pronounced, but the
minute spines are arranged in the same manner as in α, either giving a close or open reticulation on the surface of the spore or grouped more or less in clusters (not evenly distributed as in the faintly warty spores of S. splendens). These two varieties represent well-marked centres, but there is no definite boundary between them denoting a true specific difference; sporangia widely differing in length and with long or short stalks may have spores of either form; γ occurs with both large and small spores. Rostafinski's types of S. fusca from Vera Cruz (B. M. 631) and from Ruda Guzowska (Strassb. Herb.) have the spores not smooth, as he describes, but of a form intermediate between α and β, 7 to 8 μ diam., with about 28 meshes of reticulation on the hemisphere. S. dictyospora Rost. appears to be an unnecessary name; it is represented in Kew Herb. by the two types referred to in Rost., Mon., App., p. 27; one from Ceylon (K. 1622) bearing the signature of Rostafinski is S. fusca β and has small spores 5 to 6·5 μ diam., reticulated in the same manner as in the Strassburg type of S. fusca, but more faintly; the other type is from Venezuela (K. 1620, B. M. 648) on a palm leaf, and in poor condition; it was marked by Berkeley S. trechispora; the spores are 10 to 12 μ diam., with a strong complete reticulation in the form of raised bands giving an even border to the spore 1 μ broad. These examples might be taken as representing the extreme limits in size and reticulation of the spores of S. fusca. The specimen from Venezuela, however, differs so considerably from its nearest allies in the strong and banded reticulation of the spores, that it is a question whether it might not be retained for the present as a distinct species under Berkeley's name of S. trechispora. A type specimen of S. maxima Schwein, received from Dr. Rex of Philadelphia (2097, N. American Fungi, Ellis and Everhart, L:B.M.82), has the spores 7 μ diam., with reticulation precisely of the form above described in Rostafinski's type of S. fusca in Strassb. Herb. The type of S. nigrescens Rex, kindly furnished by Dr. Rex, has dark spores as in α, but only 7 μ diam. S. Castillensis Maibrade, from Nicaragua (B. M. 1002) presents no characters by which it can be separated from S. fusca β; the spores are distinctly reticulated, and measure 6 to 7 μ. The confluent form of the sporangia is in some cases seen throughout the whole development from one plasmodium, the capillitium consisting of a profuse network of arching threads, with broad expansions at the nodes, but sometimes only a part presents the confluent form, and is associated with more or less perfect sporangia with the normal superficial net. An exceptional form of γ confluens is figured in Plate LXXVII. (L:B.M.82); it was found in Epping Forest developing from white plasmodium on dead leaves near rotten wood. The sporangia are combined into a convolute aethalialoid mass, the membranous sporangium-walls are to a great extent persistent; no stalks are developed, but in one case the whole aethalium is suspended by a long slender thread of hypothallus; the columellae are wanting, and the capillitium is represented by a scanty network of irregular threads with many wide expansions, attached at the extremities to the sporangium-walls. The spores are perfectly formed, 6 μ diam., minutely warty, with the warts here and there connected by faint lines suggesting the appearance of a reticulation. This development is interesting as showing to what extent variation may occur; if it were not connected with the type with intermediate forms, the position of the specimen might be difficult to determine. The description and figure of Amaurochete speciosa Zukal (i.e.) leave little doubt that his species is the form γ of S. fusca.
On dead leaves, wood.—a, β, γ. Leytonstone, Essex (L:B.M.82); a, β, γ. Lyme Regis, Dorset (L:B.M.82); β. Batheaston, Somerset (B.M. 208); γ. Edinburgh (K. 796); a, and β. France (Paris Herb.); Germany, a. (B. M. 623); γ (B. M. 650); a. Austria (B. M. 626); a. Italy (B. M. 621); β. Poland (Strassb. Herb.); β. Russia (Paris Herb.); β. Ceylon (K. 1622); a. and β. Java (K. 1591); β. Australia (B. M. 635); β. New Zealand (K. 666); β. New Caledonia (Paris Herb.); a. Tonga (L:B.M.82); a. Philadelphia (L:B.M.82); β. Iowa (L:B.M. 82); β. Texas (B. M. 919); β. Nicaragua (B. M. 1002); a. French Guiana (Paris Herb.); β. Vera Cruz (B. M. 631); β. Para, Brazil (K. 686); Venezuela (Stemonitis trechispora), (B. M. 648).

2. **S. splendens** Rost., Mon., p. 195 (1875). Plasmodium creamy white, on fir stumps, etc., maturing at the place of emergence. Total height 6 to 12 mm. Sporangia cylindrical, obtuse, stipitate, purplish-brown, at first closely fasciculate. Stalk black, shining, slender, 1 to 4 mm. long, rising from a well-developed silvery or purplish hypothallus. Columella reaching to near the apex of the sporangium, rigid, sometimes weak and flexuose in the upper half. Capillitium of purplish-brown threads, the principal branches varying in intricacy, but usually springing at distant intervals from the columella, at first almost simple, suddenly branching to form a superficial net with smooth, rounded, variously shaped meshes, 20—100 µ wide. Spores pale reddish-purple, nearly smooth, or minutely and closely warted, 7 to 9 µ diam.—**Stemonitis Morgani** Peck, in Bot. Gaz., v., p. 33; Mass., Mon., p. 86; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 142. **S. maxima** Mass. (non Schwein.), Mon., p. 74. **S. Bauerlinii** Mass., Mon., p. 79; Rex, in Proc. Acad. Nat. Sc. Phil. (1890), p. 36. **S. Webberi** Rex, l.c. (1891), p. 390. **S. acuminata** Mass., Mon., p. 78. **S. confluentes** Cke. & Ellis in Grev., v., p. 51; Mass., Mon., p. 77.

a. **genuina**: superficial net of capillitium complete, with rounded meshes, 20 to 70 µ diam.

β. **Webberi**: sporangia stiff, erect; superficial net complete, with meshes 80 to 100 µ wide.

γ. **flaccida**: sporangia weak, adhering; capillitium lax, scarcely forming a superficial net; membranous flakes of sporangium-wall always present.

δ. **confluentes**: sporangia confluent, without superficial net.

Plate XLIII., A.—a, b, c, sporangia, a. **genuina**, × 2; d, capillitium of Rostafinski's type from Texas, × 180; e, capillitium with membranous expansion, from Rostafinski's type (Cuba), × 180; f, capillitium of type of **S. Morgani** Peck, × 180; g, sporangia, γ. **flaccida**, × 2; h, capillitium of the same, with membranous expansion, × 180 (England); i, spore, × 600.

Var. δ. corresponds with the confluent form of **S. fusca**; the capillitium forms a dense intricate network, connected with indefinite branching columella, with frequent membranous saucer-shaped expansions, without stalks or superficial net. The specimen from N. Carolina (Curtis, 419), named **Lachnobolus cibrosus** (B. M. 935) appears to be this variety, and the note by Fries following his description of
L. cribrosus (Syst. Myc., iii., p. 87) implies that he probably had the confluent form of a Stemonitis before him. *S. confluenis* Cke. & Ellis, from New Jersey, Ellis (K. 665; and L:B.M.83, part of the same gathering, furnished by Dr. Rex), appears also to be a confluent form of *S. splendens*; the spores in both the N. Carolina and New Jersey specimens have the typical sculpture, but are darker than usual, and measure 9 to 10 μ diam. A specimen from Meudon in the collection of the Paris Museum closely resembles that from New Jersey in the character of the capillitium; the spores have also the same dark tint, and measure 10 to 11 μ; but the sporangia are more normal, having in some cases a simple columella and a nearly complete superficial net with a wide mesh. Only three or four European gatherings of this species are represented in the Strassburg, Brit. Mus., and Kew Collections; it is plentiful in India, America, Australia, and the Pacific Islands, from which regions there are numerous specimens in the collections, which were classed under *S. fusca*, until Rostafinski detected the specific characters and gave the name of *S. splendens*. The capillitium in this species exhibits wide differences, but the spores are remarkably constant in colour, size, and in the minute, evenly distributed warts, which are sometimes scarcely apparent, even when magnified 1,200 diam.; their distribution resembles that on the spores of *Physarum nutans*. The superficial net of the capillitium appears to be continuous with the evanescent sporangium-wall, which is not merely attached by short spines projecting from the net as in *S. fusca*; this character is illustrated by a remarkable form described by Dr. Rex (Proc. Acad. Nat. Sc. Phil., 1890, p. 36) under the name *S. Bauerlinii* Mass., *f. fenestrata*. He records the appearance of successive growths of the *Stemonitis* at considerable intervals of time, on a limited area of a decaying log, apparently from one original source. Through the courtesy of Dr. Rex the gatherings are represented in the mountings in the Brit. Mus. In mounting (a) the sporangium-wall is persistent except in approximate circular perforations 10 to 20 μ wide, or in other words the superficial net is expanded to form a perforated wall to the sporangium. Mounting (b) is from a later gathering, with much of the character of (a), but approaching nearer to the normal form. Mounting (c) is from a crop appearing a month later than (b), in which there is a still more marked return to the usual habit, with the meshes of the net 30 to 60 μ wide. The width of the mesh varies in Rostafinski's types from Cuba and Texas (referred to Rost., App., p. 27); in that from Cuba (B. M. 630) the average width of the mesh is 70 μ, in that from Texas (K. 1631) it is 20 μ. *S. Morgani* Peck, N. Am. Fungi, Ellis & Everh. 2088, and *S. Bauerlinii* Mass., from New Guinea (K. 726), are essentially the same form as the Cuba type, the mesh of the superficial net averaging about 60 μ in width, *S. Webberi* Rex (*f. β*) has a wider mesh than the Cuba type, and is described (Lc. 1891, p. 391) as distinguished from *S. splendens* by the spores being ferruginous-coloured in mass, and by the pale surface capillitium; the mounted specimens do not show this difference of colour. The form gathered at Lyme Regis in 1891 (Journ. Bot. 1891, p. 263), var. γ, has even more lax and broken capillitium than var. β, and the spores in mass are rich purple-brown; the growth has appeared on the same fir stumps in abundance in 1892 and 1893, with much the same characters as in the first gathering. It has also been obtained from the New Forest, Hants, from the Black Forest near Freiburg, and from Ohio. The type specimen of *S. acuminata* Mass. (K. 698) is *a. genuina*, the spores measuring 7 to 8 μ diam. In looking through
a large series of specimens of this group there is a general character
which runs through them all in the constant type of the spores and
in the smooth purple-brown capillitium, which points to the conclusion
that however widely the size of the mesh of the surface-net may vary,
they are all forms of one species.

Hab. On dead wood.—γ. Lyme Regis, Dorset (L:B.M.83); δ. Meudon,
France (Paris Herb.); a. Germany (B. M. 619); γ. Black Forest
(L:B.M.83); a. Italy (B. M. 999); a. Natal (K. 694); a. Australia
(K. 716); a. New Zealand (K. 688); a. Isle of Pines, New Caledonia
(B. M. 1093); a. Samoa (L:B.M.83); a. Iowa (B. M. 820); δ. New
Jersey (L:B.M.83); β. and γ. Ohio (L:B.M.83); a. S. Carolina
(B. M. 918); a. Darien (B. M. 916); a. Cuba (B. M. 630); a. French
Guiana (Paris Herb.); a. Brazil (B. M. 1089).

Plasmodium? Sporangia cylindrical, in densely fasciculated
clusters, 5 to 7 mm. high, red-brown. Stalk 0·8 mm. high,
arising from a membranous hypothallus. Capillitium of dark
brown threads, springing from the columella and forming a very
loose network, uniting at the surface into a net with rounded
meshes, 7 to 17 μ diam. Spores pale reddish-purple, minutely
spinulose, 6 to 9 μ diam.—Mass., Mon., p. 87.

Plate XLIII., B.—a. sporangia on leaf, × 2 (Java, leg. Zollinger); b.
capillitium of same, × 170; c. sporangia. Peck's type, × 2 (U.S.A.); d.
capillitium of same, × 170; e. sporangia on leaf, natural size (Rangoon);
f. sporangia, × 2; g. capillitium of same, × 170; h. spore, × 600.

The above description is made from Peck's type, kindly furnished
by Dr. Rex. The species is allied to S. ferruginea and to S. splendens,
having the capillitium, and the habit of fruiting on herbaceous stems,
of the former, and the purplish spores of the latter. It holds an
intermediate position, different gatherings showing a tendency towards
one or the other of its allies; but it is a useful centre under which to
place forms possessing a distinct general character which were difficult
to locate before Peck gave them a specific rank. It does not appear
in the collections as a British species, and European gatherings are not
frequent. The specimen figured from Java was given by Rostafinski
as a type of S. fusca, from which it is distinguished by the nearly
smooth spores and wandering habit of the plasmodium. Peck's type is
nearly identical with the Java specimen (see Pl. XLIII., B., c and d).

Hab. On leaves, etc.—France (K. 706); Germany (Strassb. Herb. as
Stemonitis fusca var. minor leiosperma de Barry); Switzerland (K. 1606);
Pondicherry, India (B. M. 84); Ceylon (K. 1624); Rangoon (K. 1612);
Java (B. M. 1091); Borneo (L:B.M.84); Australia (K. 711); New
York (L:B.M.84); Carolina (K. 1581); S. Domingo (B. M. 640).

Plasmodium citron-yellow, in rotten wood, usually creeping from
the place of emergence, and maturing on surrounding herbage.
Total height 5 to 7 mm. Sporangia cylindrical, obtuse, in
closely fasciculate clusters, stipitate or nearly sessile, cinnamon-
brown. Stalk black, 0·5 to 1·5 mm. high. Columella often
reaching the apex of the sporangium and expanding as a funnel-
shaped membranous cap, or ceasing far below the summit,
Capillitium of ferruginous or brown threads, springing from the columella, and forming a loose network with numerous broad membranous expansions; meshes of the delicate, superficial net, angular, varying from 6 to 16 μ diam. Spores pale ferruginous, faintly warded, 6 to 9 μ diam.—Rost., Mon., p. 196 (in part); Cooke, Myx. Brit., p. 60 (in part); Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 9; Mass., Mon., p. 85 (in part).

Plate XLIV., A.—a. sporangia, × 2; b. capillitium, × 180; c. capillitium and columella expanded to form a membranous cap at the apex of the sporangium, × 180; d. spore, × 600 (England).

Hab. On leaves and dead wood.—Lyne Regis, Dorset (L:B.M.85); Leighwood, Somerset (B. M. 206); Hartham, Wilts (B. M. 210); France (Paris Herb.); Germany (K. 778); Freiburg (Strassb. Herb.); Hungary (K. 1616).


Plate XLIV., A.—e. sporangia of various sizes, × 2 (England); f. capillitium, × 180 (Central America); g. spore, × 600.

The type specimen from Nicaragua has smaller and more delicate sporangia than the usual form, which is found throughout the world. The longer stalks and minute spores characterise all gatherings, and distinguish this species from *S. ferruginea*. The twenty-six specimens in the Kew Herb. are marked *S. microspora* Lister, but the description of *S. Smithii* is the first published account of the species.

Hab. On dead wood.—Epping Forest, Essex (L:B.M.86); Dudley, Stafford (L:B.M.86); Luton, Beds (L:B.M.86); Berlin (B. M. 622); Freiburg, Germany (Strassb. Herb.); Bohemia (K. 729); Mauritius (K. 752); Ceylon (B. M. 646); New Zealand (K. 771); Australia (K. 758); Mass., U.S.A. (B. M. 641); Iowa (B. M. 819, 1005); S. Carolina (B. M. 644); Nicaragua (B. M. 1004); Darien (B. M. 643); Chili (Paris Herb.); Brazil (B. M. 1092).

**Species not met with in the quoted collections**

6. *S. Tubulina* Alb. & Schw., Conspt., p. 102. Æthalium at first white, soft, 1 ½ to 2 inches broad, 4 to 6 lines high, orbicular, rarely suboblong, basal membranes stout, silvery, pellucid, iridescent, easily removable from the substratum; surface smooth, shining, with hemispherical warts above, corresponding to the
apices of the component sporangia; columella brown, slender, capillary, aggregated, but for the most part individually free; capillitium loosely interwoven into a common mass; mass of spores brown.

_Hob._ On decorticated pines.—Germany.

This description applies to _S. splendens, γ. flaccida_; but without the character of the spore-markings, which could not be discerned by the older authors, no certain conclusion as to the species can be arrived at.

7. _S. fluminensis_ Speg., in Ann. Soc. Cient. Argent, xii., p. 255 (1881). Hypothallus very thin, broadly effused, mucinous, black, rather shining; stem erect, rather rigid, black, shining, 0·5 to 1 mm. long, 0·6 to 0·7 mm. thick; smooth when moist, rugulose when dry, subcontorted, extending into the sporangium as a columella, not reaching to the apex; sporangium cylindrical, rarely subclavate, rounded at both ends, 0·8 to 1·2 mm. long, 0·2 to 0·3 mm. thick, black, opaque, wall persistent for a long time; capillitium arising from the columella, forming a rather dense network, the superficial meshes equal to or twice the diameter of the spores, with uncinate incurved tips; spores 5 to 8 µ diam., smooth, smoke-brown.

_Hob._ On old bark and moss.—Brazil.

This description applies to a small form of _Comatricha typhoides._

**SPECIES EXCLUDED FROM THE GENUS.**

- _S. affinis_ Mass. = _Comatricha typhoides_ Rost.
- _S. atra_ Mass. = _Comatricha typhoides_ Rost.
- _S. Carlylei_ Mass. = _Comatricha typhoides_ Rost.
- _S. Frieseana de Bary_ = _Comatricha obtusata_ Preuss.
- _S. laxa_ Mass. = _Comatricha laxa_ Rost.
- _S. pulchella_ Bab. = _Comatricha pulchella_ Rost.
- _S. tenerrima_ Berk. & Curt. = _Comatricha pulchella_ Rost.
- _S. typhina_ Mass. = _Comatricha typhoides_ Rost.
- _S. Virginiensis_ Rex = See note under _Comatricha typhoides_ Rost.

Genus 16.—**COMATRICHA** Preuss, in Linnæa, xxiv., p. 140 (1851). Sporangia cylindrical, ovoid or globose, gregarious or scattered; sporangium-wall evanescent (subpersistent in _C. typhoides_), stipitate, the stalk extending within the sporangium as a columella for half its length or more, branching above, and continued into the crisped or flexuose capillitium, which consists of numerous threads rising from all parts of the columella, combined into a more or less uniform network, not forming a superficial net.
The genus *Comatricha* is a somewhat artificial one; it includes species which agree with *Lamproderma* in all characters but the persistent sporangium-wall, and with *Smonitis* in all but the presence of the superficial net of the capillitium; in *C. typhoides* the surface net is often developed on the lower half of the sporangium; at the same time it is a useful genus, typically marked by the uniform network of the capillitium and by the isolated, not fasciculate, growth of the sporangia.

**KEY TO THE SPECIES OF COMATRICA.**

A. Spores dark, brownish-violet, or grey:—

a. Spores nearly smooth—

Capillitium dense, crisped, and flexuose throughout; on wood.

1. *C. obtusata*

Capillitium large, primary branches stout and nearly straight; on wood.

2. *C. laxa*

b. Spores spinulose—

Sporangia globose; on leaves.

3. *C. lurida*

Sporangia much elongated, slender and cylindrical; on wood.

4. *C. longa*

B. Spores pale, lilac, or reddish-lilac:—

a. Spores marked with a few widely scattered warts, the remaining surface nearly smooth or delicately reticulated, 4 to 6 μ diam.; on wood.

5. *C. typhoides*

b. Spores spinulose, 6 to 10 μ diam.—

Sporangium-wall completely evanescent; on leaves.

6. *C. Persoonii*

Sporangium-wall persistent at the base as a membranous cup; on leaves.

7. *C. rubens*

1. *Comatricha obtusata* Preuss, l.c., p. 141 (1851). Plasmodium watery-white, in rotten wood, maturing at the place of emergence. Total height 1 to 6 mm. Sporangia globose, ellipsoid or cylindrical, stipitate, scattered or gregarious, about 0·6 mm. diam., purplish-brown; sporangium-wall evanescent. Stalk subulate, slender, black, shining; in the globose form usually 2 to 6 times the length of the sporangium; equalling the length of the sporangium, or shorter in the cylindrical form; rising from a more or less distinct hypothallus. Columella reaching to half the height, or nearly to the apex of the sporangium, branching above and continued into the capillitium. Capillitium a more or less dense tangle of purplish-brown threads, springing from all parts of the columella, anastomosing and branching in semicircular curves; of nearly equal thickness throughout, the ultimate branches looped, showing few free ends, but connected.

Plate XLIV., B.—a. sporangia of various forms, × 3½; b. sporangia with spores dispersed, showing capillitium, × 20; c. capillitium with flexuose threads, forming a loose tangled network, × 180; d. capillitium with much branching flexuose threads forming a close network, × 180; e. capillitium with threads uniting to form a superficial net more or less parallel with the surface, × 180; f. spore, × 600 (England).

A very abundant species in Europe, and subject to much variation in the shape and size of the sporangium. *C. æqualis* Peck has cylindrical sporangia about 3 mm. long, and stalks of the same length; the capillitium and spores, 7 μ diam., agree with those of *C. obtusata*, from elongated forms of which *C. æqualis* cannot be distinguished. *C. subcæspitosa* Peck is a small delicate form, 2 mm. in height, with sporangia ellipsoid, and capillitium a network of slender flexuose violet-brown threads, forming a more or less distinct superficial net in the lower part; the spores are almost smooth, and measure 10 to 11 μ; although an unusually short-stalked delicate form, it presents no characters by which it can be separated from *C. obtusata*. *C. Suksdorffii* Ellis & Everh. is about the same height as *C. æqualis*; the capillitium is very dense, but not more so than is frequently seen in globose sporangia of *C. obtusata*; the spores are unusually dark and large, 10 to 11 μ; the tone of colour and the distribution of the minute warts are, however, the same as in the last-named species, from which it is not otherwise to be distinguished; a similar form has been found in England, with spores 8 to 10 μ diam. *C. æqualis* Peck, *C. subcæspitosa* Peck, and *C. Suksdorffii* are represented in the British Museum by glycerine jelly mountings from type specimens furnished by Dr. Rex.

*Hab.* On dead wood.—Batheaston, Somerset (B. M. 220); Lyme Regis, Dorset (L:B:M.87); Boynton, Yorkshire (B. M. 1095); France (Paris Herb.); Germany (B. M. 605); Finland (B. M. 612); Poland (Strassb. Herb.); Philadelphia (L:B:M.87).

2. *C. laxa* Rost., *Mon.*, p. 201 (1875). Plasmodium watery-white, in rotten wood. Total height, 1'5 to 3-5 mm. Sporangia subglobose or shortly cylindrical, obtuse, scattered or gregarious. Stalk black, shining, often stout, 0-3 to 0-6 mm. long. Columella reaching nearly to the apex of the sporangium, narrowed upwards. Capillitium lax, the primary threads springing somewhat distantly from all parts of the columella, at first straight or

Plate XLIV., B.—a. sporangia of various forms on wood and bramble, \( \times 3 \frac{1}{2} \); b. sporangia with spores dispersed, showing capillitium. \( \times 20 \); i. apex of columella, and capillitium threads, \( \times 180 \); k. spore, \( \times 600 \) (England).

Intermediate forms connect this species with *C. obtusata*, of which it is hardly more than a marked variety. The type in the Strassburg collection is well rendered by the photographic figure in Rostafinski's Monograph; it is a globose form with coarse and lax capillitium. A similar form is found at Lyme Regis, together with growths having more elongated sporangia; among these there occur forms which are identical with *C. Ellisiana* Ellis & Everh. (K. 1590), and with specimens furnished by Dr. Rex under the same name (L:B:M.88). *C. Sommerfeltii* Blytt has the lax capillitium of Rostafinski's type of *C. laxa*, with larger spores, 11 to 14 \( \mu \) diam.; the size of the spores, which in other respects are those of *C. laxa*, can scarcely support a separate specific rank being given to this gathering. I am indebted to Prof. Blytt for kindly submitting the type of *C. Sommerfeltii* for examination.

_Hab._ On dead wood, twigs, etc.—Leytonstone, Essex (L:M.B.88); Lyme Regis, Dorset (L:B:M.88); Germany (Strassb. Herb.); Norway (L:B:M.88); Philadelphia (L:B:M.88); S. Carolina (B. M. 922).

3. *C. lurida* Lister, sp. nov. Plasmodium? Total height 1:25 mm. Sporangia globose or subovoid, erect, 0:5 mm. diam., stipitate, scattered, purplish-brown; sporangium-wall evanescent. Stalk setaceous, black, shining, 0:75 mm. long, rising from a circular brown hypothallus. Columella cylindrical, reaching to half the height of the sporangium, dividing into stout branches at the apex, and continued into the capillitium. Capillitium dark purplish-brown throughout, spreading from the upper part of the columella in flexuose anastomosing threads, with slender, brown, free ends. Spores spherical or subovoid, purplish-grey, coarsely warted, 8 to 10 \( \mu \) diam.

Plate XLV., B.—a. sporangia, \( \times 3 \frac{1}{2} \); b. columella and capillitium, with a fragment of sporangium-wall, to which spores adhere, \( \times 180 \); c. spore, \( \times 600 \) (England).

This species has occurred at Lyme Regis during several years, with constant characters; it has the habit of *Lamproderma irideum*, from which it is distinguished by the more branching columella, the uniform colour of the flexuose capillitium, and also in the larger and more strongly warted spores. It resembles some forms of *C. obtusata*, differing essentially in the spores and habitat.

_Hab._ On dead leaves.—Lyme Regis, Dorset (L:B:M.89).

cylindrical, elongated and slender, flexuose or drooping, stipitate, at first fasciculate, greyish-black; sporangium-wall evanescent. Stalk very slender, 1 to 3 mm. long, black, rising from a well-developed, membranous hypothallus. Columnella continued to near the apex of the sporangium, very slender, and wavy with angular flexures in the upper part, tapering in breadth from 20 μ at the base to 2 μ near the summit. Capillitium a lax network of dark brown threads, the terminal branches rigid, free, forking at an acute angle. Spores dark grey, spinulose, the spines usually connected by faint lines forming a reticulation, 8 to 9 μ diam.—Macbride, in Bull. Nat. Hist. Iowa, ii., p. 140; Morgan, Cinc. Soc. Nat. Hist., xvi., p. 50. Stemonitis longa

a. genuina: capillitium rigid; spores spinulose, reticulated.


Plate XLV., A.—a., b. sporangia, a. genuina, × 3½; c. capillitium from upper part of sporangium, with slender flexuose columnella, × 180; d. capillitium from lower part of another sporangium, × 180; e. spores of same, showing varying amount of reticulation, × 600; f. sporangia of β. irregularis, × 3½; g. capillitium, × 180; h. spore of same, × 600; i. spore of C. crypta Macbride, showing faint indication of reticulation, × 600 (U.S.A.).

From the absence of any superficial net in the capillitium this species is placed in Comatricha, though in its fasciculate habit it resembles a Stemonitis. In a, the capillitium varies in different gatherings; in some the threads are comparatively short, rigid throughout, and anastomosing but little; in others they form a profuse network with many membranous expansions, and very slender free ends, but the character of the dark spinulose spores remains constant in all forms. β is described by Dr. Rex (l.c., p. 393) under the name of Comatricha irregularis; the terminal branches of the capillitium are produced into a network of pale flaccid threads with many free ends; Dr. Rex (in litt.) states that this form is constant in the character of the capillitium, and that it has been obtained from five states in North America; the total length of the sporangia varies from about 4 to 7 mm., but the close resemblance in the capillitium and spores to forms of C. longa leads to the conclusion that it is a varietal development of that species. It is the form described under the name of C. crypta Macbride, l.c. (teste Rex). The type specimen of Stemonitis crypta Schwein. is, Dr. Rex states, utterly lost, and the description is too vague to be of value.

Hab. On the bark of fallen trees (teste Macbride).—a. and β. Ohio (L:B:M.90); a. Philadelphia (B. M. 900); β. Philadelphia (L:B:M.90); β. Iowa (B. M. 1006); a. S. Carolina (B. M. 915); a. Cuba (K. 1603); a. Nicaragua (K. 718).

5. C. typhoides Rost., Versuch, p. 7 (1873). Plasmodium watery-white, in rotten wood. Total height 2 to 3 mm. Sporangia cylindrical, obtuse, at first silvery-grey from the presence of the soon evanescent wall, then brown; stipitate, aggregated, 1.5 to
2·3 mm. long, 0·5 mm. broad. Stalk black, often clothed with the grey membranous continuation of the sporangium-wall; 0·5 to 1·3 mm. long, 0·06 mm. thick, rising from a well-developed hypothallus. Columella reaching nearly to the summit of the sporangium, branching at the apex. Capillitium a close network of flexuose, pale-brown threads, springing from all parts of the columella, the ultimate branches more slender, free, or continuous and looped in the lower half, resembling the superficial net of *Stemonitis*. Spores pale lilac-brown, marked with 3 to 5 dark, flattened warts on the hemisphere; otherwise almost smooth, minutely warted or faintly reticulated, 3·5 to 7 μ diam.—*Trichia typhoides* Bull., Champ., p. 119 (1891). *Stemonitis typhoides* DC., Fl. Franc., ii., p. 257. *Stemonitis typhina* Wiggers, Prim. Fl. Hols., p. 110 (1780); Pers., Obs., i., 57; Mass., Mon., p. 74. *Comatricha typhina* Rost., Mon., p. 197 (1875); Cooke, Myx. Brit., p. 47. *C. affinis* Rost., Mon., p. 202. *Stemonitis affinis* Mass., Mon., p. 76. *S. atrae* Mass., Mon., p. 78. *S. Carlylei* Mass., Mon., p. 84.

α. genuina: sporangium-wall subpersistent; spores 6 to 7 μ diam., surface almost smooth, or minutely warted between the larger warts.


γ. microspora: sporangium-wall evanescent; spores 3·5 to 4·5 μ diam., sculpture of spores as in β.

Plate XLVI., A.—α. sporangia, α. genuina, × 3½; b, c. dense and lax forms of capillitium, × 180; d, e. spores of the same, showing widely scattered warts, × 600 (England); f. sporangia, β. heterospora, × 3½; g. spore, faintly reticulated between the warts, × 600 (U.S.A.); h. sporangia, γ. microspora, × 3½; i. capillitium, × 180; j. spore, × 600 (England); k. spore of *Stemonitis Virginicus Rex*, × 600 (U.S.A.).

Plate XLVI., B.—α. sporangia intermediate between α and β, × 3½; b. capillitium, × 180; c. spore, minutely warted between the large scattered warts, × 600 (Iowa).

The capillitium varies in the closeness of the network; forms occur in which the threads are less flexuose, and bear nearly the same relation to the type as *C. laxa* to *C. obtusata*. The scattered warts on the spores, the existence of which was first pointed out by Dr. Rex, is a character which, although requiring a high magnifying power to identify, is present in all the varieties given above, and is additional evidence that they all belong to a single species. γ. microspora is represented by a gathering in perfect development from Lyme Regis; in form and colour it resembles β, but the spores are uniformly minute. A specimen received from Mr. Morgan, Ohio, is almost identical, with spores of the same size. Specimens of *C. typhoides*, α., have been received from Prof. Macbride, Iowa, under the name of *C. pulchella* (B. M. 1007); the sporangia are cylindrical, and the spores, which measure 6 to 7 μ, are marked with minute warts, and a few inconspicuous larger warts. This form is connected with the more usual type by other specimens from Iowa with minutely warted spores in which the few larger warts are well developed (L:B:M:91; Plate XLVI., B, α. to c.). The type of *C. affinis* Rost.,
from Freiburg, in the Strassburg collection, is not well developed, as shown by the abundance of immature spores; but the capillitium is that of _C. typhoides_, and the spores have the characteristic scattered warts. _Stemonitis atra_ Mass., from New Zealand (K. 727), has spores 6 to 8 μ diam., and appears to be the usual form of _C. typhoides_. _S. Carlylei_ Mass. (Herb. Massée) is also _C. typhoides, a. genuina_, with almost colourless spores 6 to 7 μ diam., marked with the scattered warts. _Stemonitis Virginicus_ Rex, Proc. Acad. Nat. Sc. Phil. (1891), p. 391 (L:B.M.91) is represented by a single extensive gathering in the Alleghany Mountains, Virginia. The minute sporangia, 3·5 mm, in total height, are clustered but not fasciculated; the capillitium is an intricate network of delicate threads with an indefinite superficial net and numerous free ends; the spores measure about 6 μ diam., and show a distinct reticulation when magnified 1,200 diam. The more clearly reticulated spores appear to afford the only distinctive character separating it from _C. typhoides_ var. _heterospora_; a high magnifying power shows the dark scattered warts before referred to.

_Hab_. On dead wood. _Common._—a. Leytonstone, Essex (L:B.M.91); y. Lyme Regis, Dorset (L:B.M.91); France (Paris Herb.); _a. Germany_ (Strassb. Herb., B. M. 629); _a. Poland_ (Strassb. Herb.); _a. Italy_ (B. M. 628); _a. India_ (K. 1580); _a. New Zealand_ (K. 727); _a. and B. Philadelphia_ (L:B.M.91); _Iowa_ (L:B.M.91); _a. S. Carolina_ (B. M. 633).


_a. genuina_: sporangia shortly cylindrical, 0·7 to 1 mm. high, on short stalks; spores pale brown with a lilac tinge.

_β. tenerrima_: sporangia narrowly ovoid, 0·4 to 0·7 mm. high, on stalks of the same length, capillitium threads very delicate; spores flesh-coloured. _Stemonitis tenerrima_ Curtis _Lc._

Plate XLVI., B.—_d. sporangia, a. genuina, × 3½; e. capillitium, × 180; f. spore, × 600; g. sporangia, β. tenerrima, × 3½; h. capillitium, × 180; i. spore, × 600 (England).

The description of _S. tenerrima_ Mass., Mon., p. 81, with spores black in mass, 13 to 14 μ diam., can only be accounted for by some confusion of specimens, as it agrees neither with Berkeley’s type (K. 1588), nor with his description in Grevillea.
a. genuina is the type most abundant in Europe.

\( \beta \). tenerrima is the type of *Stemonitis tenerrima* Berk. & Curt., from S. Carolina; it occurs in Ravenel's Coll. (B. M. 902) under the name of Comatricha pulchella; it has also been found at Lyme Regis, Comatricha gracilis Wing. (No. 2094, Ellis & Everhart, 2nd Series, K. 1589) is similar to specimens furnished by Dr. Rex as a small form of *C. Persoonii* (L:B.M.92); it differs from the usual type in the very faintly and closely warted spores.

*Hab.* On dead leaves, etc.—a. and γ. Lyme Regis, Dorset (L:B.M.92); a. Leytoustone, Essex (L:B.M.92); a. Luton, Beds. (L:B.M.92); β. Philadelphia (L:B.M.92); α. S. Carolina (B. M. 904b); γ. S. Carolina (B. M. 902).

7. *C. rubens* Lister, sp. nov. Plasmodium watery-white. Total height 1 to 2 mm. Sporangia obovoid, ellipsoid, or subglobeose, stipitate, erect or inclined, scattered, 0·5 to 0·8 mm. long, 0·3 to 0·5 broad, pinkish-brown, shining below; sporangium-wall evanescent above, membranous and persistent in the lower quarter, pinkish-brown. Stalk setaceous, black, shining, 0·6 to 1·3 mm. long, rising from a circular brown hypothallus. Columella reaching to about two-thirds the height of the sporangium, branching at the apex. Capillitium of brownish-violet threads, springing from all parts of the columella, broad at the base, more or less flexuose, anastomosing and branching at wide angles, often with flat expansions, gradually narrowing to the delicate straight free ends; the persistent base of the sporangium-wall is connected with the lower part of the columella by capillitium threads with broad attachments. Spores pale lilac-brown, minutely spinulose, 7 to 8 μ diam.

Plate XLV., B.—d. sporangia, × 3½; e. columella and capillitium, with the basal part of sporangium-wall persistent, × 180; f. spore, × 600 (England).

This species has occurred at Lyme Regis two years in succession, and has also been obtained in Yorkshire and Bedfordshire. Specimens from America supplied by Dr. Rex are of precisely the same form as the English gatherings. The spores are similar to those of *C. Persoonii*, to which species it appears to be allied. The persistent wall at the base of the sporangium is a constant character, showing an approach to the genus Lamproderma.

*Hab.* On dead leaves.—Lyme Regis, Dorset (L:B.M.93); Philadelphia (L:B.M.93).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**

8. *C. macrosperma* Racib., in Rozpr. Mat. Przyr. Akad. Krak., xii., p. 76 (1884). Sporangia obovate, or oblong, naked, stipitate; columella tapering upwards, ceasing below the apex; capillitium arising from the columella, its branches combined into a not dense net, becoming gradually more slender towards the circumference, where, especially in the lower part of the sporangium, their curved extremities unite to form a superficial net. Spores pale violet, verruculose, 9·9 to 12 μ diam. Var. *obovata*, sporangia 0·5 to
0·75 mm. broad. Var. obonga, sporangia 0·75 to 1 mm. long, 0·3 to 0·5 mm. broad.

_Hab._ Near Cracow.

This description applies to a form of _C. obtusata_ with spores rather more distinctly warded than usual.

**Genus 17. ENERTHENEMA** Bowman, in Trans. Linn. Soc., xvi., p. 152 (1830). Sporangia stipitate; columella reaching to the apex of the sporangium; capillitium springing from beneath the superficially extended end of the columella.

1. _E. elegans_ Bowm., _l.c._, p. 152, tab. 16 (1830). Plasmodium watery-white. Total height 1 to 1·5 mm. Sporangia globose, stipitate, erect, gregarious, 0·5 to 0·75 mm. diam., dull black, crowned with the small iridescent salver-shaped apex of the columella; sporangium-wall evanescent. Stalk conical, black. Columella slender, cylindrical from a conical base, traversing the sporangium and expanding on the surface into a membranous umbilicate disc 0·1 to 0·2 mm. broad. Capillitium threads spreading from the expanded apex of the columella, long, slender, black, sparingly branched, straight or flexuose. Spores greyish-brown, spinulose, 8 to 10 μ diam.—_Mass._, _Mon._, p. 105. _Stemonitis papillata_ Pers., in Römer, _N. Mag. Bot._, p. 90; _Berk._ in _Eng. Fl._, vol. v., ii., p. 317. _Enerthenema papillata_ Rost., _Mon._, _App._, p. 28; Cooke, _Myx._ Brit., p. 51. _E. elegans_ _Berk._ & _Br._ in _Ann. Mag. Nat. Hist._, _Ser._ 2, vol. v., p. 366. _E. Berkleyana_ _Rost._, _Mon._, _App._, p. 29; _Mass._, _Mon._, p. 106. _Ancyrophorus crassipes_ _Raunk._, in _Bot._ _Tidssk._, xvii., p. 93, _t._ _v._, _figs._ 8, 9; _Mass._, _Mon._, p. 107.

Plate XLVII., A.—a. sporangia, × 20; _b._ sporangia with spores dispersed, showing capillitium arising from under the apical disc of the columella, × 35; _c._ sporangia with capillitium arising from the whole length of the columella, and anastomosing to form more or less of a network; found in company with sporangia with normal capillitium, × 35; _d._ spore, × 600 (England).

Occasionally the capillitium threads are much branched and spring from all parts of the columella, which may then terminate below the apex of the sporangium; but all conditions between this and the normal form occur in the same group of sporangia. The account with the figure of _Ancyrophorus crassipes_ _Raunk._, _l.c._, well describes this variety. In what remains of the type of _E. Berkleyanum_ _Rost._, from S. Carolina (K. 1643), no spores of an _Enerthenema_ can be detected; the specimen is beset with clusters of brown spores or dividing cells of a parasitic fungus. Berkeley and Broome describe this specimen as having the "spores produced in little heads surrounded by a common vesicle at the free apices of the flocci," and of this being "almost the only case in which the spores of a _Myxogaster_ have been observed _in situ_; _Ptychogaster_ is the single exception." The sporangia are of the typical form of _E. elegans_, and it appears possible that the mould was mistaken by Berkeley and Broome for the true spores.

_Hab._ On dead wood.—Wanstead, Essex (L:B.M.94); Lyme Regis, Dorset (L:B.M.94); Portbury, Somerset (B. M. 236); Batheaston, Somerset (B. M. 238); Edinburgh (K. 1642); Germany (Strassb. Herb.); _S._ Carolina (K. 1643).
SPECIES EXCLUDED FROM THE GENUS.


Genus 18.—**LAMPRODERMA** Rostafinski, Versuch, p. 7 (1873). Sporangia stalked, globose or ellipsoid; sporangium-wall membranous, somewhat persistent, shining with iridescent colours; stalk black; columella cylindrical or clavate, reaching to half or more than half the height of the sporangium; capillitium consisting of branched anastomosing threads, radiating from the upper part of the columella.

**KEY TO THE SPECIES OF LAMPRODERMA.**

**A.** Total height 2 to 3 mm.

Capillitium purplish throughout, spores spinulose, 10 to 13 μ.  
1. *L. physaroides*

Capillitium black or grey, spores echinulate, 15 to 20 μ.  
2. *L. echinulatum*

**B.** Total height 1 to 1.5 mm.

a. Columella branching at the apex.  
3. *L. arcyrionema*

b. Columella obtuse or truncate.

Threads of capillitium dark, pale at the base.  
4. *L. irideum*

Threads of capillitium dark or pale, not paler at the base.  
5. *L. violaceum*

1. *L. physaroides* Rost., Mon., p. 202 (1875), and App., p. 25. Plasmodium? Total height 2 to 3 mm. Sporangia globose or ellipsoid, stipitate, erect, rarely sessile, gregarious, 0.5 to 0.8 mm. diam., purplish-black with broken iridescent reflections, or shining like burnished brass; sporangium-wall membranous, persistent, purplish in the lower part, usually mottled with darker shades. Stalk cylindrical, usually 1.5 mm. high, 0.15 mm. thick, purplish-black, shining, longitudinally striate or rugose, rising from a dark purplish hypothallus. Columella cylindrical with a conical apex, or clavate, reaching to more than half the height of the sporangium. Capillitium of purple-brown threads, rarely pale, radiating chiefly from the upper part of the columella, sparingly forked and anastomosing; towards the surface branching and forming a delicate, nearly colourless network. Spores purple-grey, closely spinulose, 11 to 14 μ diam.—Cooke, Myx. Brit., p. 49; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 7; Mass., Mon., p. 103. *Stemonitis physaroides* Alb. & Schw., Conspr. Fung., p. 103 (1805). *Physarum columbinum* Pers., Obs. Myc., i., p. 5. *Lamproderma columbinum* Rost., Versuch, p. 7; in Fuckel, Symb., Nachtr, p. 69; Mon., p. 203; Mass., Mon., p. 100. *Physarum iridescens* Berk., in Hook. Journ. (1851), p. 20. *Lamproderma iridescens* Rost., Mon., App., p. 25.
a. genuinum: sporangia stalked.

b. sessile: sporangia sessile.

Plate XLVII., B.—a. sporangia, × 3½; b. sporangia, a. genuinum, × 20; c. columella and capillitium, × 80; d. columellae of various shapes, from one group of sporangia, × 20; e. sporangia, b. sessile, × 20; f. capillitium of same, × 80; g. spore, × 600 (England).

The form sessile is represented by five separate gatherings. One from the Pyrenees, on Hepaticae, is the type of Stemonitis iridescens Berk. (K. 1318); the sporangia, now broken, were globose, and either sessile or on short stalks; the capillitium is described by Rostafinski as colourless, but in the sporangium examined, the few threads that remain are dark-brown; the columella is absent, but the base of the sporangium is thickened by a tissue of interwoven bands; the spores are purple-grey as in the type of L. physaroides. The second gathering is from Christiania, named L. columbinum, kindly furnished by Professor Bllytt (L:B.M.95); it is on moss in company with the long stalked form of L. physaroides; the globose sporangia are each seated on a horny base of dried plasmodium; there is no stalk or columella; the capillitium rises from the broad base of the sporangium and resembles that of the stalked form; the spores measure 16 to 19 μ; in the accompanying stipitate sporangia they measure 12 to 13 μ. Two other gatherings are from near Leighton Buzzard, one on fir bark, the other on dead leaves; the sporangia are entirely without stalk or columella; the capillitium rises from the broad membranous base of the colourless sporangium-wall; the threads are much branched and colourless at the base, dark purple-brown, forked and anastomosing above; the spores are as in the type, 10 μ diam. The fifth is a gathering on fir bark by Mr. Saunders, at Flitwick, Beds; the sporangia are dull-brown; the sporangium-wall pale amber, subcartilaginous, thickened at the base by interwoven folds as in the specimen from the Pyrenees; the capillitium is abundant, of almost simple purple-brown threads, pale at the points of attachment to the sporangium-wall; the spores are of the typical colour and roughness, 9 to 11 μ diam. The form genuinum of this species is very constant in its main characters, yet it is met with in the collections almost as frequently under the name of L. columbinum as of L. physaroides. It is probable that both names were originally given to the same species, and that Albertini and Schweinitz were not acquainted with Persoon's type of Physarum columbinum when they gave the name of S. physaroides. The Strassburg collection does not here assist us. There are three specimens in that collection marked as Rostafinski's types of L. columbinum; one is L. physaroides, one is the pale form of L. violaceum, and the third is L. irideum. The type of L. physaroides at Strassburg is the species described above in the text, and the same as that supplied by de Bary to Professor Bayley Balfour under that name; this nomenclature having become established, L. columbinum is here placed as a synonym for L. physaroides.

Hab. On fir-wood, moss, etc.—a. Hanham, Gloucester (B.M. 204,205); a. B. Leighton, Beds (L:B.M.95); a. Moffat, Scotland (L:B.M.95); a. France (K. 628); a. Germany (B M. 603, 604); b. Pyrenees (K. 1318); a. and b. Norway (L:B.M.95); a. Mass., U.S.A. (L:B.M.95).

2. L. echinulatum Rost., Mon., App., p. 25 (1876). Plasmodium? Total height 2 to 2.5 mm. Sporangia globose, stipitate, erect, gregarious, 0.5 to 1 mm. diam., steel-blue, iridescent; sporangium-wall membranous, somewhat persistent, purplish or
fuliginous. Stalk subulate or cylindrical, 1 to 1.5 mm. long, black, rising from a well-developed hypothallus. Columella cylindrical, obtuse, about half the height of the sporangium. Capillitium black or cinereous, spreading chiefly from the upper part of the columella, threads stout, sparingly forked and anastomosing, colourless and slender at the tips. Spores dark grey, echinulate with black spines, 15 to 20 μ diam.—Lister, in Journ. Bot. (1891), p. 261; Mass., Mon., p. 97. Stemonitis echinulata Berk. in Hook. Fl. Tasm., p. 268 (1860). Lamproderma Listeri Mass., Mon., p. 97.

Plate XLVIII, A.—a. sporangia, × 3½ (New Zealand); b. columella of same, × 80; c. sporangia, × 3½ (Tasmania); d. columella and capillitium of same, × 80; e. sporangia, × 3½ (Moffat); f. columella and capillitium, × 80; g. spore, × 600.

In the type specimen from Tasmania many of the stalks are misshapen and tumid, and the primary branches of the capillitium are soon lost in a flaccid network of grey threads with broad expansions at the nodes; somewhat similar appearances are met with both in the stalks and capillitium of L. violaceum when matured under unfavourable conditions, and it appears probable that this specimen is not a perfect development; the primary threads in some parts are continuous and branched towards the surface in the manner usual in Lamproderma. The specimen from New Zealand is mouldy and difficult to examine, but the capillitium forms less of a network, and more nearly approaches the Moffat gathering, which is in perfect development, and is that described in the text and in the Journ. Bot., l.c. The remarkable spores are of the same character in all the specimens, and until further examples are obtained it would seem well to include them under one species.

Hab. On dead wood.—Moffat, Scotland (L.B.M.96); Tasmania (K. 1621); New Zealand (L.B.M.96).

3. L. arcyronema Rost., Mon., p. 208, App. p. 26 (1875). Plasmodium watery-white, in rotten wood. Total height 1 to 1.5 mm. Sporangia globose, stipitate, erect, aggregated, 0.5 mm. diam., steel-grey or bronze with iridescent reflections; sporangium-wall membranous, falling away in large fragments, often persistent as a collar round the base of the sporangium. Stalk subulate-setaceous, about 1 mm. high, black, shining. Columella slender, smooth, cylindrical, about 12 μ broad, reaching to one-third or one-half the height of the sporangium, suddenly dividing at the apex into the primary branches of the capillitium. Capillitium of dark purple-brown threads arising from the apex of the columella, branching repeatedly and anastomosing to form a close crisped network, with very short free ends. Spores lilac-grey, smooth or very faintly warded, 6 to 7 μ diam.—Mass., Mon., p. 96. Stemonitis physaroides var. subaeneus Berk., in Mass., Mon., p. 95. Lamproderma subaeneum Mass., l.c. Comatricha Shimikiana Macbride, in Bull. Nat. Hist. Iowa, ii., p. 380, Pl. x., fig. 3.

Plate XLVIII, B.—a. sporangia, × 3½ (United States); b. capillitium of same, × 180; c. sporangia, × 20 (England); d. columella and capillitium, × 80; e. spore, × 600.
This species is not uncommon in the United States, where it is described by Dr. Rex as sometimes occurring in vast abundance, "covering one entire side of a fallen log about 3 feet in diameter for a length of about 10 feet with the steel-coloured sporangia." The specimens named by Berkeley Stemonitis physaroides var. subaenues, from Ohio (K. 1560, 1562), correspond in every respect, in size, capillus, and in the spores, which measure 6 to 7 µ, with Rostafinski's type of Lamproderma arcyrionema in Strassb. Herb. Comatricha Shimekiana Macbride, from Nicaragua (B. M. 1008), is a typical form of L. arcyrionema.

Hab. On dead wood.—Epping Forest, Essex (L.B.M.97); France (Paris Herb.); Poland (L.B.M.97); Borneo (L.B.M.97); Philadelphia (L.B.M.97); Ohio (L.B.M.97); Nicaragua (B. M. 1008).

4. L. irideum Mass., Mon., p. 95 (1892). Plasmodium watery-white, among dead leaves. Total height 1 to 1·5 mm. Sporangia globose, stipitate, erect, scattered or gregarious, 0·3 to 0·5 mm. diam., steel-blue or bronze, brilliantly iridescent; sporangium-wall delicately membranous, colourless, soon falling away in large fragments. Stalk setaceous, black, shining, rising from a purple-brown circular hypothallus. Columella cylindrical, truncate, scarcely reaching to half the height of the sporangium. Capillitium of rigid threads, radiating from the apex of the columella, dichotomously branching and anastomosing, black, purple-brown, rarely pale brown, pale at the base, rigid and coloured to the free extremities; the threads connecting the apex of the columella with the somewhat persistent base of the sporangium-wall usually delicate and colourless. Spores violet-grey, minutely warted, 6·5 to 8 µ diam.—Stemonitis scintillans Berk. & Br., in Journ. Linn. Soc., xv., p. 2 (1877). Lamproderma arcyrionoides var. iridea Cooke, Myx. Brit., p. 50 (1877). Enerthenema muscorum Lév., in Ann. Sc. Nat., Ser. iv., xx., p. 289.

Plate L., A.—a, sporangia, × 3½; b, sporangia, × 20; c, columella and capillitium, × 80; d, branching thread of capillitium, showing the colourless base, × 180; e, spores, × 600 (England).

This species resembles some forms of L. violaceum, but is marked by the colourless base of the capillitium threads where they spring from the truncate apex of the columella; apart from the character of the capillitium, which is liable to some variation, it can always be distinguished by the spores, which instead of being minutely and closely spinulose, as in the pale-spored form of L. violaceum, are beset with scattered warts, which can easily be counted when magnified 1,500 diam., and number about thirty on the hemisphere. It is a most abundant species in England; in heaps of dead leaves it appears in countless numbers, and in a dark fir plantation near Lyme Regis the stones and herbage by the side of a rivulet appeared hoary over an area of many square yards with the young rising sporangia, and a little search showed the mature forms in equal abundance. The specimen in the Kew Collection from Ceylon (K. 1634) has the same character as the English gatherings, and is accurately described by Berkeley under the name of Stemonitis scintillans (i.e.). There are several specimens of this species in the Kew Collection, named L. arcyrionoides var. iridea Cke. (K. 615—619); these are referred to in Mr. Massee's
Monograph, p. 95, and described as having smooth spores measuring 11 to 16 μ, which is misleading. Specimens received from the United States, representing several gatherings, agree in all respects with the type. The type of *Euerthelema muscorum* Lév. from New Granada (B. M. 1023) is a form of *L. irideum* with scattered sporangia on setaceous stalks, and dark capillitium; the spores measure 8 to 9 μ, and are marked with 20 to 24 strong warts on the surface of the hemisphere, not including those seen on the margin. The warts is unusually pronounced, but in all other respects the specimen corresponds with frequent English gatherings.

*Hab.* On dead leaves. Common.—Lyne Regis, Dorset (L:B.M.91); Batheaston, Somerset (B. M. 194, 201); Highgate, London (B. M. 1111); France (B. M. 617); Poland (Strassb. Herb.); Ceylon (K. 1634); Philadelphia (L:B.M.98); Ohio (L:B.M.98); Iowa (B. M. 1000); S. Carolina (B. M. 846); New Granada (B. M. 1032).

5. *L. violaceum* Rost., Versuch, p. 7 (1873). Plasmodium watery-white. Total height 0·6 to 1·5 mm. Sporangia sub-globose, more or less flattened and umbilicate beneath, or shortly ellipsoid, stipitate, erect, scattered or aggregated, 0·4 to 0·9 mm. diam., violet or bronze with iridescent reflections; sporangium-wall membranous, somewhat persistent, pale violet-brown. Stalk varying from very short to one and a half times the height of the sporangium, black, rising from a red-brown membranous hypothallus. Columella one-third to two-thirds the height of the sporangium, cylindrical, obtuse, or sometimes narrowing to the apex. Capillitium of almost colourless, pale brown or dark violet-brown threads, springing from the upper part of the columella; in the pale form branching and anastomosing in a flaccid network, becoming very slender towards the surface, varying in density in the same group of sporangia; in the dark form the threads are either lax, or coarse and rigid, or flexuose and forming a close network. Spores purplish-grey or purple-brown, nearly smooth or minutely or strongly spinulose, 8 to 15 μ diam.—In Fuekel, Symb. Nachtr., p. 69; Mon., p. 204; Cooke, Myx. Brit., p. 50; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 8; Mass., Mon., p. 94. *Stemonitis violacea* Fr., Syst. Myc., iii., p. 162 (1829). *Stemonitis arcyrioides* Somm., in Mag. Nat., vii., p. 298 (1827). Lamproderma arcyrioides Rost., Mon., p. 206; Blytt, l.c., p. 8; Cooke, Myx. Brit., p. 50; Mass., Mon., p. 102. *Stemonitis Carestiae* Ces. & de Not., Erb. Crit. Ital., No. 888. Lamproderma Sauteri Rost., Mon., p. 205; Mass., Mon., p. 100. Lamproderma robusta Ellis & Everh., in Mass., Mon., p. 99. Tilmadoche Berkeleyi Mass., Mon., p. 332.

a. *genuinum* : sporangia globose, flattened beneath; stalk slender; capillitium nearly colourless, sometimes brown, flaccid; spores 8 to 10 μ diam., minutely spinulose.

β. *Sauteri* : sporangia globose or subovoid; thickened below; capillitium brown; spores 11 to 15 μ diam., nearly smooth or spinose.
γ. Carestiae: sporangia subovoid; stalk short, stout; capillitium dense, dark violet-brown; spores 8 to 15 μ diam., nearly smooth or spinose.

Plate XLIX. A.—a. sporangia, a. genuinum, × 3½; b. sporangia, × 20; c. capillitium, × 80; d. spore, × 600 (England); e. small sporangia, × 3½ (United States); f. capillitium, β. Sauteri, × 80; g. spore of same, × 600 (Tyrol: Rostafinski's type of L. Sauteri); h. sporangia, γ. Carestiae, × 3½; i. capillitium, × 80; j. spore of same, × 600 (Italy: type of Sphomitiis Carestiae Cesati); k. spore, × 600 (Jura Mts.:Fuckel, Fung. Rhen., 1417, one of Rostafinski's types of L. acryrioides).

Plate XLIX. B.—a. sporangia, type of Sphomitiis acryrioides Somm., × 20; b. columnella and capillitium, × 50; c. capillitium and spores, × 280; d. spore, × 600 (Norway).

The three varieties given above are well-marked centres, round which intermediate forms group themselves, and are essentially represented under their respective names by specimens in the Strassb. Herb.; but neither the size of the spores, the colour of the capillitium, nor the shape of the sporangia can be taken as giving constant specific characters. In some gatherings with dark and coarse capillitium the spores measure 9 μ diam., in others 11 to 14 μ diam.; they are either minutely or strongly spinulose. The original gathering on which Sommerfelt founded his S. acryrioides, of which, through the courtesy of Prof. Blytt of Christiania, a mounting is in the Brit. Mus. Coll., has globose sporangia, with brown capillitium and nearly smooth spores 8 to 9 μ diam. The measurement "12.5 to 16.5 μ" given by Rostafinski, and repeated in other works, is erroneous, but is corrected by Prof. Blytt, l.c. It is a form of a. genuinum with dense capillitium. L. Sauteri Rost. has the same form of sporangium and brown capillitium as S. acryrioides Somm., but has spinulose spores 11 to 14 μ diam.; it is the type of β. In-Lyme Regis gatherings with pale, minutely spinulose spores, 8 to 10 μ diam., the capillitium is either almost colourless and flaccid, or brown and rigid, sometimes varying in sporangia on the same leaf. The characters on which specific differences can be based being so unstable, it appears reasonable to consider the three forms as varieties of one species. Lamproderma robusta Ellis & Everh., No. 39, N. Amer. Fun., as represented by the specimen received by Mr. Massee from Mr. Wingate, is β, with dark, strongly spinulose spores 11 to 13 μ diam.; it is almost identical with the type of L. Sauteri in the Strassb. Herb. The type of Tilmadoche Berkeleyi Mass., from the United States (K. 1563A), appears to be an immature specimen of L. violaceum.

Hab. On dead wood, leaves, etc.—a. Twycross, Leicester (B. M. 203r); Brockley, Somerset (B. M. 202); a. β. Lyme Regis, Dorset (L:B:M.99); a. France (Paris Herb.); a. β, γ. Germany (Strassb. Herb.); β, γ. Germany (B. M. 607); a. Norway (L:B:M.99); γ. Switzerland (B. M. 608); γ. Italy (B. M. 606); a. Mass., U.S.A (L:B:M.99); β. Philadelphia (L:B:M.99); γ. Iowa, Ohio (L:B:M.99).

Species not met with in the quoted collections.

6. L. Schimperi Rost., Mon., p. 203. Sporangia globose, iridescent, greenish-black or reddish. Stalk black, shining, rigid, subulate, 3 to 4 mm. high, 0·6 mm. thick below, 0·15 mm. above. Columella obovate, hardly attaining half the height of the sporangium. Capillitium dusky, as in L. physaroides. Spores dull violet, delicately warted, 10 to 11 μ diam. Differing from
*L. physaroides*, which it very closely resembles, in the shape of the columella, and the smaller size and less strong warts of the spores.

*Hab.* Alsace (Schimper).

The characters above given are frequently met with in typical developments of *L. physaroides*.


*Hab.* Eberbach, Germany (Fuckel); Paris (Roze). The specimen from Roze has colourless capillitium.

This description applies to *L. violaceum*.

8. *L. Fuckelianum* Rost., in Fuckel, Symb., Nachtr., p. 69 (1873). Sporangia globose, almost sessile, 0·75 mm. diam., iridescent red, slightly umbilicate beneath. Stem short, inconspicuous, penetrating the sporangium as a short conical columella. Capillitium loosely branching, combined into a network by transverse branchlets. Spores pale violet, marked with minute ridges uniting to form a reticulation, 8 to 9 µ. diam.—Mon., p. 207, tab. xiii., fig. 6.

*Hab.* On the twigs and leaves of oak.—Eberbach, Germany (Fuckel).


*Hab.* Near Paris (Roze).

This description applies to a form of *L. irideum* with pale capillitium.

10. *L. nigrescens* Sacc., in Mich., ii., p. 262 (non Rost.) Sporangia gregarious, stipitate, globose, not umbilicate, smooth, erect, at first yellowish, then opaque black. Stalks filiform, 0·5 mm. high, 40 µ. thick, black, with a small reddish hypothallus. Columella cylindrical, reaching half the height of the sporangium, giving rise at the obtuse apex to the radiating, dichotomously branching, filiform, dusky threads of the capillitium. Spores dull violet, very minutely echinulate, 9 to 10 µ. diam.—*L. Saccardianum* Mass., Mon., p. 101.

*Hab.* On heaps of dead leaves and twigs.—N. Italy.

From the size of the spores it is probable that this is a minute form of *L. violaceum*.

purple, rather dull. Capillitium originating from the apex of the short columella, threads blackish-purple, very slender, equal throughout, repeatedly forking from the base, angles very acute.

Stem coloured like the sporangium and twice as long, slender above, becoming very thick downwards, and expanding into a small circular hypothallus. Spores in clusters of five to seven, globose when free, pale lilac, minutely warted, 15 to 16 \( \mu \) diam. About 1 mm. high.—Mass., Mon., p. 98. Badhamia penetralis Cooke & Ellis, Grev., v., p. 49.

*Hab.* On pine boards.—New Jersey.

Nothing now remains in the Kew Herb. (K. 614) of the specimens first issued by Ellis under the name of *B. penetralis* but a few subulate stalks. The specimens issued as *Comatricha Ellisiana* syn. *Lamproderma Ellisiana* Cke., Badhamia penetralis Cke. & Ellis, 2nd series, No. 2696 (K. 1590), are *Comatricha laxa*.

12. **L. Lycopodii** Raunk., in Bot. Tidsskr., xvii., p. 109. Sporangia scattered, globose, sessile on a violet-brown hypothallus; wall, columella, capillitium, and spores violet-brown; the lower part of the wall remains with tattered margin. Columella cylindrical, reaching nearly half the height of the sporangium, giving rise in the upper part only to the capillitium, whose threads fork more and more towards the surface of the sporangium, where they are combined into a net by transverse branches, the extremities almost colourless. Spores furnished with a delicate network of fine thickenings, 12 to 18 \( \mu \) diam.—*Stemonitis cribrarioides* Fr., Syst. Myc., iii., p. 163. *Cribaria Lycopodii* Fr. Nees, in Raunk. *l.c.*

*Hab.* On the leaves of *Lycopodium*.—Zealand.

**SPECIES EXCLUDED FROM THE GENUS.**

**L. Hookeri** Rost. = *Chondrioderma Hookeri* List.

Genus 19.—**CLASTODERMA** Blytt, in Bot. Zeit., xxxviii., p. 343 (1880); sporangia stalked, without lime; columella very short or hardly evident; capillitium arising from the apex of the columella in solid lilac or ochraceous threads, repeatedly forking, sparingly anastomosing; sporangium-wall dividing into subhyaline, membranous, rounded oblong or subpolygonal fragments, attached to one or from two to five of the ultimate branches of the capillitium; spores pale lilac.—*ORTHOTRICHLA* Wingate, in Journ. Myc., ii., p. 125 (1886).

1. **C. Debaryanum** Blytt, Bot. Zeit., xxxviii., p. 343 (1880). Plasmodium? Total height 1 to 1.25 mm. Sporangia globose, stipitate, gregarious, 0.15 to 0.2 mm. diam., brown; sporangium-wall membranous, persistent only in circular or polygonal plates attached to the ultimate branches of the capillitium. Stalks slender, rugose below, suddenly smooth and filiform in the upper fifth, brown. Columella short, dividing into the primary branches of the capillitium. Capillitium of pale brown threads, forking three or four times, sparingly anastomosing at the surface or free,
the ultimate branches attached singly or two or three together to the membranous plates of the sporangium-wall. Spores pale lilac, smooth, 7 to 10 μ diam.—Christ. Vidensk. Forh., No. 4 (1882); Bidr. K. Norg., Sop. iii. (1892), p. 7. Orthotrichia microcephala Wing., l.c.; Mass., Mon., p. 109.

Plate L., B.—a. sporangia, × 20; b. apex of stem, capillitium, and spores, × 280; c. part of capillitium from another sporangium, × 280 (United States); d. capillitium with expanded membranous plates, × 280 (Norway); e. spore, × 600; f. sporangium, × 20 (Norway).

This species was discovered by Prof. Blytt in 1879, near Christiania, growing on dead Polyergus. In the United States it has been repeatedly found, and described by Mr. Wingate as Orthotrichia microcephala. In these gatherings the threads anastomose more freely than in the Norwegian specimen, and the disc-shaped fragments of the sporangium-wall are usually less pronounced. In some sporangia, however, they agree essentially with the type kindly submitted for examination by Prof. Blytt, and it cannot be doubted that they are the same species.

Hab. On dead wood.—Norway (Christiania Herb.); Borneo (L:B.M.100); Philadelphia (B. M. 874); Ohio (L:B.M.100).

ALLIED GENERA NOT MET WITH IN THE QUOTED COLLECTIONS.

RACIBORSKIA Berl., in Sacc. Syll., vii, p. 400 (1888). Sporangia naked, globose, stipitate. Stem produced into a columella one-third or half the height of the sporangium, bearing at its apex short, slender, secondary columella, which branch again in a similar manner, the ultimate branches combining to form a network without free ends.—Rostafinskia Racib., in Rozpr. Mat. Przyr. Akad. Krak., xii., p. 77 (1884).

1. R. elegans Berl., l.c. Sporangia naked, globose, 0·5 mm. broad. Stalks erect, 1 to 2 mm. high, subulate, furrowed, black. Columella cylindrical, 8 to 10 μ wide. Capillitium blackish-violet, the branches becoming gradually more slender outwards, the ultimate branchlets furnished with scattered spines. Spores dull violet, 9 to 10 μ diam.—Rostafinskia elegans Racib., l.c., p. 78.

Hab. Botanical Gardens, Cracow.

This description applies to Comatricha obtusata, in which the columella frequently branches in a dichotomous manner.

ECHINOSTELIUM de Bary, in Rost., Versuch, p. 7 (1873). Sporangia stalked, minute, naked, without columella. Capillitium arising from the apex of the stalk, its branches forming a network.

1. E. minutum de Bary, in Rost., Mon., p. 215, figs. 53, 54, 58, 68. Sporangia scattered, stipitate, globose, 37 to 57 μ diam., naked, whitish. Stalk 0·28 to 0·46 mm. high, brownish below, pale above. Capillitium of curved branching threads, with acute free branches. Spores entirely colourless, 6·7 to 8·3 μ diam.

Hab. Frankfort-on-Maine.
Order II.—Amurochætaceæ. Sporangia combined into an æthalium. Capillitium dark purple-brown, of irregular strands and threads, or of complex structure.

KEY TO THE GENERA OF AMAUROCHÆTACEÆ.
Capillitium of irregularly branching threads.

(20) Amurochæte.

![Image of Amaurochæte atra](image1)

Fig. 28.—Amaurochæte atra Rost.

a. Æthalium. Half natural size.
b. Capillitium. Magnified 10 times.

Capillitium of horizontal threads, with many-chambered vesicles.

(21) Brefeldia.

![Image of Brefeldia maxima](image2)

Fig. 29.—Brefeldia maxima Rost.

a. Æthalium. Natural size.
b. Capillitium and spores. Magnified 50 times.

Genus 20.—Amurochæte Rostafinski, Versuch, p. 8 (1873). Æthalia pulvinate, composed of elongated closely compacted confluent sporangia; sporangium-walls not developed. Capillitium rising from the broad membranous base, consisting of dark purple-brown irregularly flattened ragged strands, dividing into many anastomosing branches, which vary much in length and thickness.


Plate LII., A.—a. capillitium, x 20; b. spore, x 600 (England).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

2. A. minor Sacc. & Ellis, in Michelia, ii., p. 566. Effused, varying, oblong, adnate-applanate, the margin almost naked, externally clay-colour, very minutely punctate, internally blackish. Capillitium threads filiform, sparingly branched and anastomosing, very pale brown. Spores blackish, minutely warted, then quite smooth, 15 μ diam.

Hab. On twigs.—Utah.

This description suggests an imperfect specimen of Dictydiæthalium plumbeum.

Genus 21.—BREFELDIA Rostafinski, Versuch, p. 8 (1873). Æthalia pulvinate, consisting of subcylindrical, somewhat branched and confluent sporangia, rising from a base of spongy barren tissue, which is continued, chiefly among the lower portions of the sporangia, in irregular folds, sometimes forming imperfect sporangium-walls and central columelle. Capillitium of numerous horizontal threads, uniting at the surface of the sporangium to form many-chambered vesicles.

1. B. maxima Rost., Versuch, p. 8 (1873). Plasmodium white, in rotten stumps of fir, beech, etc. Æthalia 2 to 16 cm. broad, 5 to 10 mm. thick, purplish-brown, composed of elongated branching sporangia 0·3 to 0·5 mm. diam., extending upwards from the spongy basal tissue, which is continued among them as irregularly branching, purple-brown membranous folds, usually forming distinct rigid columelle. Capillitium consisting of numerous threads radiating from near the central part of the sporangium; each thread expands at the boundary of the sporangium into a many-chambered vesicle, which is continued into a corresponding radial thread of the adjoining sporangium. The proximal ends of the threads are slightly attached in clusters of three or four by a fragile membrane. The vesicles are of firm structure, often containing a spore in several of the chambers, with no appearance of forming part of the sporangium-wall, except where they occasionally coalesce in fewer or greater numbers to form vertical scalariform strands. Spores purplish-brown, minutely spinulose, 9 to 12 μ diam.—Mon., p. 213; Cooke, Myx. Brit., p. 53; Mass., Mon., p. 91; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 389. Reticularia maxima Fr., Syst. Orb. Veg., i., p. 147 (1825). Licea perreptans Berk., in Gard. Chron. (1848), p. 451.

Plate LII., A.—c. subdiagrammatic view of portions of four columnar sporangia from an Æthaliuim; each sporangium has a central columella, and is clothed on the surface with numerous vesicles, from which short capillitium threads pass into the adjacent sporangia; at a is seen a scalariform strand, formed by vertical union of a row of vesicles, × 50; d. capillitium threads and vesicles, × 180; e. spore, × 600 (England).
The complex structure of the capillitium is difficult to follow in the lower part of the aethalium; towards the surface the sporangia are often separated from each other by a narrow interval. The sides of the sporangia are then seen to glitter with the numberless vesicles of the capillitium. The threads penetrate the adjacent sporangia to the distance of 0·07 to 0·1 mm., or about half the radius. The entire length of the threads, including the central vesicle, is 0·15 to 0·23 mm. The spores in the central part of the sporangium do not seem to be traversed by any threads. In the lower strata the threads are sometimes attached at each extremity to folds of the membrane arising from the spongy base; but the rigid collumellae, throughout the upper part at least, appear to be free from the capillitium.

_Hab._ On dead wood.—Lyme Regis, Dorset (L:B.M.102); Darenth, Kent (B. M. 1110); Wanstead, Essex (L:B.M.102); Luton, Beds (L:B.M.102); near Birmingham (L:B.M.102); Boynton, Yorkshire (B. M. 1159); France (Paris Herb.); Sweden (K. 781); Germany (Strassb. Herb.); Mass., U.S.A. (L:B.M.102); Iowa (B. M. 1020).

_Rostafinsjcia australis_ Spag., in Ann. Soc. Cient. Argent., x., p. 151 (1880), is described as forming an aethalium and having the surface composed of softly velvety tomentum, breaking up into powdery filaments; the capillitium tubes of the lower stratum septate; the spores lilac, ovoid or irregular, 8 to 10 × 5 to 6 μ. It does not appear to be a Mycetozoon.

Cohort II.—_LAMPROSPORALES._ Spores variously coloured, never violet.

Subcohort I.—_ANEMINEÆ_ Rost. (extended). Capillitium not forming a system of uniform threads; either wanting, or represented by modifications of the sporangium-wall, which may be perforated or laciniate in aethalioid sporangia, or produced into tubular extensions in exceptional forms in the order _Tubulinaceae._

Order I.—_HETERODERMACEÆ_ Rost. (extended). Sporangium-wall membranous, beset with microscopic round granules (plasmodic granules), and, except in _Lindbladia_, forming a net in the upper part; capillitium wanting; spores 4 to 7 μ diam.

KEY TO THE GENERA OF _HETERODERMACEÆ_.

Sporangia sessile, compacted or aethalioid, the wall not forming a net in the upper part.

(22) _Lindbladia_

_Fig. 30._ _Lindbladia Tubulina_ Fries.

_a._ Aethalium. Natural size.

_b._ Vertical section of aethalium. Magnified 6 times.
Sporangia stalked; sporangium-wall with thickenings in the form of a delicate persistent net expanded at the nodes.

(23) **Cribraria.**

Fig. 31.—**Cribraria aurantiaca** Schrad.

_a._ Group of sporangia. Twice natural size.

_b._ Sporangium after dispersion of the spores. Magnified 20 times.

Sporangia stalked; sporangium-wall with thickenings in the form of nearly parallel ribs extending from the base to the apex, connected by delicate threads.

(24) **Dictydiwm.**

Fig. 32.—**Dictydiwm umbilicatum** Schrad.

_a._ Group of sporangia. Twice natural size.

_b._ Sporangium after the dispersion of spores. Magnified 20 times.

Genus 22.—**Lindbladia** Fries, Summa Veg. Scand., p. 449 (1849). Sporangia minute, either combined to form an æthalium, or closely compacted; rarely free, sessile, or stalked; sporangium-wall membranous, uniform, beset with microscopic, dark, plasmatic granules.

1. **L. Tubulina** Fries, *l.c.* (1849). Plasmodium? Sporangia minute, combined to form a more or less complex, effused or pulvine æthalium, 1 to 10 mm. thick, black with a cortex of imperfectly developed spores, or umber-brown with the surface formed by the membranous walls of the convex summits of the component sporangia; hypothallus strongly developed, of membranous, more or less spongy tissue; sometimes the sporangia are shortly cylindrical and closely compacted, sessile, 0·3 to 0·5 mm. broad; in rare instances they are free and shortly stalked; sporangium-wall membranous, yellow-brown, uniform, beset with scattered clusters of dark, round, plasmatic granules, 1 μ diam. Stalk, when present, short, dark brown, rugose. Spores ochraceous-brown, faintly warty, 4 to 6 μ diam.—*Licea effusa* Ehr., Sylv. Myc. Berol., p. 26 (1818). *Lindbladia effusa* Rost., Mon., p. 223 (1875); Cooke, Myx. Brit., p. 55; Maébride, in Bull. Nat. Hist. Iowa, ii., p. 115; Rex, in Bot. Gaz., xvii., p. 201. **Tubulina**

a. genuina: sporangia combined into an øthalium.

B. simplex Rex: sporangia shortly cylindrical, closely compacted, sessile, rarely free and stalked.

Plate I.I., B.—a. vertical section of part of a pulvinate øthalium, x 9; b. fragment of sporangium-wall and spores, x 280; c. closely compacted tubular sporangia, B. simplex, x 9; d. sessile and stalked sporangia, B. simplex, closely allied to Cribraria argillacea, x 9; e. fragment of sporangium-wall, and spores of same, x 280; f. spore, x 600 (United States).

The form B. simplex has hitherto been recorded only from the United States, and has been described by Dr. Rex (l.c.), where he gives a full account of the genus Lindbladia and of the relationship which exists between L. effusa and Cribraria argillacea. His gatherings show a complete series of intermediate forms between the two species. Licea spermoides Berk. & Curt. is var. simplex of Rex; it is represented by several specimens in the Kew Collection, including the type from Alabama referred to by Rostafinski in his App., p. 32, and given by him as a synonym for Cribraria argillacea (K. 1695); the sporangium-wall is bestrewn with dark plasmodic granules, but there is no indication of a net to warrant its being placed under C. argillacea.

Hab. On dead wood, etc.—a. Bulmer, Yorks (L:B.M.103); a. Aboyne, Scotland (B. M. 241); a. Sweden (K. 1658); a. and B. Philadelphia (L:B.M.103); B. Iowa (B. M. 822); B. S. Carolina (B. M. 948).

Genus 23.—Cribraria Persoon, in Römer, Neues Mag. Bot., i., p. 91 (1794). Sporangia globose or subpyriform, stipitate; sporangium-wall persistent, and forming a cup in the lower half, or reduced to a basal disc, continued above in a net of slender threads more or less expanded and thickened at the nodes; the wall membranous and evanescent in the meshes of the net.

KEY TO THE SPECIES OF CRIBRARIA.

A. Nodes of the net not expanded:—

A. Sporangia clay-coloured, cup imperfectly defined, sporangium-wall subpersistent above. 1. C. argillacea

b. Sporangia crimson. 2. C. rubiginosa

c. Sporangia rufous or nut-brown, cup well-defined or obsolete—

Sporangia 0·6 mm. diam. 3. C. rufescens

Sporangia 0·1 to 0·2 mm. diam. 4. C. minutissima
B. Nodes of the net expanded:—

a. Sporangia nut-brown—
   a. Cup perforated at the margin, merging into the branching nodes. 5. C. macrocarpa
   b. Cup well-defined, nodes flattened, angular, branching, continued into the connecting threads. 6. C. aurantiaca
   c. Cup replaced by strong ribs, nodes flattened. 7. C. splendidens
   d. Cup well-defined or absent, nodes thickened, prominent, numerous—
      Nodes with many free rays, connected by more or less parallel delicate threads. 8. C. intricata
      Nodes rounded in outline, with few or no free rays, connected by three to five delicate threads. 9. C. tenella

b. Sporangia purple- or red-brown—
   a. Stalk two to three times the height of the sporangium, plasmodic granules 2 \( \mu \) diam. 10. C. pyriformis
   b. Stalk four to six times the height of the sporangium—
      Cup one-third of the sporangium, nodes polygonal, plasmodic granules 0·5 to 1 \( \mu \) diam. 11. C. languescens
      Cup minute or absent, nodes rounded, prominent, plasmodic granules 1·5 to 2 \( \mu \) diam. 12. C. microcarpa

c. Sporangia purple—
   Cup one-third the sporangium, 0·7 mm. diam. 13. C. purpurea
   Cup one-half the sporangium, 0·5 mm. diam. 14. C. elegans

d. Sporangia violet-blue, sporangium 0·25 mm. diam. 15. C. violacea

1. C. argillacea Pers., in Römer, N. Mag. Bot., i., p. 91 (1794). Plasmodium lead-coloured, in rotten wood. Total height 0·75 to 1·5 mm. Sporangia globose, crowded, stipitate, erect, or sessile, 0·5 to 0·8 mm. diam., clay-coloured; cup imperfectly defined; sporangium-wall subpersistent throughout, delicately membranous above, stouter towards the base, reticulated with strongly or faintly thickened bands, which are beset with dark plasmodic granules 1 \( \mu \) diam., and form a net with hardly expanded nodes and subquadrangular meshes about 0·1 mm. wide. Stalk
cylindrical, 0.1 to 0.8 mm. high, furrowed, dark brown, arising from a well-developed hypothallus. Spores ochraceous, nearly smooth, 5 to 6 μ diam.—Rost., Mon., p. 238; Cooke, Myx. Brit., p. 59; Blytt, Bidr. K. Norg., Sop. iii., p. 10; Mass., Mon., p. 65. Stemonitis argillacea Pers., in Gmel., Syst. Nat., ii., p. 1469 (1791).

Plate LII., A.—a. sporangia, × 20; b. net of sporangium-wall and stalk, × 50; c. spores and plasmodic granules, × 600 (England).

This species varies much in the extent to which the net of the sporangium-wall is developed. In the usual form the bands are dark brown, well-defined, hardly expanded at the nodes, often stouter towards the base; but in some gatherings the thickenings are faint and broad, and the wall of the sporangium is nearly uniform in texture, in which case it closely resembles the form β. simplex of Lindbladia Tubulina.

Hab. On dead wood.—Richmond, Surrey (L:B.M.104); Birmingham (L:B.M.104); Leighton, Beds (L:B.M.104); Boynton, Yorkshire (B. M. 1044); Aboyne, Scotland (B. M. 243); Leicestershire (B. M. 244A); Germany (Strassb. Herb.); Norway (L:B.M.104); Philadelphia (L:B.M.104); Mass., U.S.A. (L:B.M.104).

2. C. rubiginosa Fries, Syst. Myc., iii., p. 172 (1829). Plasmodium? Total height 2 mm. Sporangia ellipsoid, shortly stalked, crowded, erect, 1.7 mm. high, 1 mm. broad, crimson; cup reaching to half the height of the sporangium, beset with minute dark plasmodic granules arranged in isolated clusters towards the base of the membranous wall, and in a reticulated pattern upwards, the lines becoming thickened and continued into the net at the somewhat perforated margin; net of delicate, dark brown, rigid threads with a mesh about 1 mm. diam., without conspicuous expansions at the nodes. Stalk rugged, dark brown, 0.3 to 0.5 mm. long, 0.2 mm. thick. Spores rufous, almost smooth, 5 to 6 μ diam.

Plate LII., B.—a. sporangia, natural size; b. sporangium after dispersion of spores, from a mounting in Canada balsam, × 20; c. net of sporangium-wall with margin of cup, × 180; d. spore, × 600 (Sweden).

This handsome species appears to be represented by the solitary Swedish gathering.


3. C. rufescens Pers., in Römer, N. Mag. Bot., i., p. 91 (1794). Plasmodium? Total height 1.5 to 2 mm. Sporangia subglobose or turbinate, scattered, stipitate, erect, 0.6 to 0.7 mm. diam., rufous-brown; cup one-third the height of the sporangium, with a regularly toothed margin, more or less ribbed, the thicker ribs continued into the wide-meshed net; the plasmodic granules of the sporangium-wall hardly 1 μ diam.; nodes of the net hardly expanded, or narrow triangular, flattened, connected by three or four firm threads. Stalk cylindrical, the length of the sporangium or more, 0.2 mm. thick, longitudinally rugose, black. Spores pale

Plate LIII., A.—a. sporangia, \( \times 20 \); b. net and cup of sporangium-wall, \( \times 50 \); c. spore and plasmodic granules, \( \times 600 \) (Scotland).

*Hab.* On dead wood.—Moffat, Scotland (L:B.M.106); Baden Baden, Germany (L:B.M.106).

4. *C. minutissima* Schwein., in Trans. Am. Phil. Soc., New Series, iv., p. 260 (1834). Plasmodium? Total height 0:5 to 0:7 mm. Sporangia globose, gregarious, stipitate, erect or inclined, 0:1 to 0:2 mm. diam., nut-brown; cup half the height of the sporangium, or more, or less, or wanting, pale nut-brown, nearly even at the margin, faintly striate longitudinally with lines of plasmodic granules 1 \( \mu \) diam.; nodes of the net hardly expanded, or narrow and flattened, connected by three to five delicate threads. Stalk filiform, one and a half to four times the height of the sporangium, brown. Spores ochraceous, almost smooth, 5 to 6:5 \( \mu \)._—Rost., Mon., App., p. 31. *Cribraria minima* Berk. & Curt., in Grev., ii., p. 67; Mass., Mon., p. 59. *C. microscopica* Berk. & Curt., in Grev., ii., p. 67; Rost., Mon., App., p. 31; Mass., Mon., p. 62.

Plate LIII., A.—a. to g. sporangia after dispersion of spores; h. spore and plasmodic granules, \( \times 600 \) (United States).

In the large gatherings obtained by Dr. Rex of this species, great variety is found in the size of the cup and in the extent to which nodes of the net are enlarged. Nothing now remains in this country of the type specimen of *C. microscopica* Berk. & Curt.; but from Berkeley's description and figure it differs from *C. minutissima* only in having the nodes of the net rather more expanded, a character so variable that the organism is here included under *C. minutissima*.

*Hab.* On dead wood.—Philadelphia (L:B.M.107); S. Carolina (B. M. 671).

5. *C. macrocarpa* Schrad., Nov. Gen. Pl., p. 8 (1797). Plasmodium? Total height 2 mm. Sporangia globose or turbinate, gregarious or scattered, stipitate, erect, 0:6 to 0:8 mm. diam., rufous-brown; cup about one-third of the sporangium, orange-brown, with numerous dark longitudinal ribs, perforated above, margin irregularly and deeply toothed, merging into the branching nodes of the net; nodes flattened, elongated, confluent and irregular in the lower part, branching and polygonal, with the angles continued into the connecting threads above; the nodes and ribs of the cup beset with dark plasmodic granules 1 to 2 \( \mu \) diam. Stalk cylindrical, 0:8 to 1 mm. high, 0:1 mm. thick, furrowed, dark brown. Spores ochraceous, nearly smooth, 4 to 6 \( \mu \) diam._—Rost., Mon., p. 238; Cooke, Myx. Brit., p. 59; Blytt, Bidr. K. Norg., Sop. iii., p. 10; Mass., Mon., p. 56.
Plate LIII., B.—\(a\). sporangia after dispersion of spores, \(\times\) 20; \(b\). part of net and cup of sporangium, \(\times\) 50 (Freiburg, Germany: Rostafinski’s type); \(c\). net and cup of sporangium, \(\times\) 50 (Black Forest, Germany); \(d\). spore, and plasmodic granules, \(\times\) 600.

Specimens from America from low elevations have usually more numerous and delicate connecting threads, and more prominent nodes in the upper part of the net; they approach forms of *C. intricata*, while the European type is coarser and more nearly resembles bold forms of *C. aurantiaca*. A gathering made by Dr. Rex at an elevation of 6,200 feet on Roan Mount, N. Carolina, exactly corresponds with Rostafinski’s type in the Strassburg collection.

**Hab.** On dead fir-wood.—Baden Baden (L:B.M.108); Germany (Strassb. Herb.); Geneva (K. 1679); Norway (L:B.M.108 slide); New York (L:B.M.108); N. Carolina (L:B.M.108).

*C. aurantiaca* Schrad., Nov. Gen. Pl., p. 5 (1797). Plasmodium sap-green. Total height 1 to 2 mm. Sporangia globose, gregarious, stipitate, erect or nodding, 0'4 to 0'7 mm. diam., nut-brown; cup one-third the height of the sporangium, irregularly and deeply toothed at the margin, beset with round plasmodic granules 0'5 to 1 \(\mu\) diam., arranged in close lines radiating from the base of the sporangium; nodes of the net flattened, broad, or narrow, branching, angular, the angles continued into the delicate connecting threads, and often into a few free rays. Stalk subulate, dark brown, two to four times the height of the sporangium. Spores golden-yellow or ochraceous, smooth, 5 to 6 \(\mu\) diam.—Rost., Mon., p. 233; Cooke, Myx. Brit., p. 58; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 10; Mass., Mon., p. 57. *Cribaria vulgaris* Schrad., l.c., p. 6; Rost., Mon., p. 234; Cooke, Myx., Brit., fig. 26; Mass., Mon., p. 61. *C. vulgaris* var. *aurantiaca* Pers., Syn. Fung., p. 194.

\(a\). Stalk one and a half times the height of the sporangium; nodes broad, polygonal.

\(b\). Stalk two to four times the height of the sporangium; nodes triangular, narrow.
Plate LIV., A.—a. to c. sporangia of various forms, with spores dispersed, × 20; d. part of net and margin of cup of sporangium, var. α, × 180; e. part of net and margin of cup, var. β, × 180; f. spores and plasmodic granules, × 600 (England).

Rostafinski’s specimens of C. vulgaris in Strassb. Herb., differ in no respect from his types of C. aurantiaca. In describing these forms of the first-named species, “a. genuina, B. aurantioides, y. delicatula,” he recognises the great variability to which it is subject, and points out how closely his form β approaches C. aurantiaca. Gatherings of this species at Lyme Regis, from the same fir logs, in consecutive years, show variations in the cup, net, and colour, which illustrate the characters given in Rostafinski’s description and figures of both C. aurantiaca and C. vulgaris; it would therefore appear necessary to place the latter name as a synonym for the wide species C. aurantiaca.

Hab. On dead fir-wood.—Lyme Regis, Dorset (L.B.M.109); Luton, Beds (L.B.M.109); Glamis, Scotland (B. M. 246, 247); France (Paris Herb.); Germany (B. M. 673, 674); Poland (Strassb. Herb.); Philadelphia (L.B.M.109).

7. C. splendens Pers., Syn. Fung., p. 191 (1801). Plasmodium? Total height 1·5 mm. Sporangia globose, stipitate, erect or inclined, scattered, 0·3 mm. diam., nut-brown; sporangium-wall consisting in the lower half of about nine free ribs with little trace of a persistent cup, continued into a loose net with narrow, somewhat triangular nodes. Stalk slender, brown, four or five times the length of the sporangium. Spores pale ochre, almost smooth, 5 μ diam.—Rost., Mon., p. 236; Mass., Mon., p. 64. Dicytium splendens Schrad., Nov. Gen. Pl., p. 14 (1797).

Plate LIII., B.—e. sporangia after dispersion of spores, × 50; f. part of net of sporangium, × 180; g. spore and plasmodic granules, × 600 (Germany: Rostafinski’s type).

The description given above is drawn from the specimen from the Feldberg near Freiberg, in Strassb. Herb., referred to by Rostafinski, l.c. It differs from C. aurantiaca, β, in the strong ribs taking the place of a hemispherical cup; in one sporangium the ribs branch into a broad net from the apex of the stalk. The persistent membranous wall mentioned by Rostafinski has almost disappeared in this somewhat injured specimen; but as the permanence of the membrane is met with occasionally in nearly every species of Cribaria, the character is not of great value.

Hab. On dead fir-wood.—Feldberg, Germany (Strassb. Herb.; L.B.M.110 slide).

8. C. intricata Schrad., Nov. Gen. Pl., p. 7 (1797). Plasmodium? Total height 1·5 to 3 mm. Sporangia globose, stipitate, nodding or erect, gregarious, 0·5 to 0·7 mm. diam., ochraceous-brown; cup one-third the height of the sporangium, or wanting, yellow-brown, beset with brown plasmodic granules 0·5 to 2 μ diam., arranged in close lines radiating from the base of the sporangium; margin more or less irregularly toothed; net close, regular; nodes numerous, dark brown, thickened, prominent, polygonal, often branching, with many free rays, and

\[a. \text{ genuina: cup about one-third the height of the sporangium.}\]

\[\beta. \text{ dictydioides: cup almost or quite obsolete, the nodes in the lower part of the net elongated and confluent, forming ribs converging to the apex of the stalk.}\]

Plate LIV., B.—*a*, *b*. sporangia after dispersion of spores, *a. genuina*, \(\times 20\); *c*. part of net and cup of sporangium, \(\times 180\) (Borneo); *d*. sporangium after dispersion of spores, *\beta. dictydioides*, \(\times 20\) (S. Carolina, U.S.A.: type of *C. dictydioides* Cooke & Balf.); *e*. spore and plasmodic granules, \(\times 600\).

The specimens in the Strassburg and Kew Herbaria (K. 963, 1673) named *Cribraria Balfourii* de Bary, on Sphagnum from the hot stoves of the Royal Botanic Gardens, Edinburgh, are small developments of *\beta. dictydioides*. Nearly similar forms have been obtained in orchid-houses at Lamberhurst, Kent.

\[\text{Hab. On dead wood.—}\beta. \text{ Bristol (L:B.M.111 slide); } \beta. \text{ hot stove R. Bot. Gardens, Edinburgh (L:B.M.111); } \beta. \text{ Java (B. M. 1107); } a. \text{ Borneo (L:B.M.111); } a. \text{ and } \beta. \text{ Philadelphia (L:B.M.111); } a. \text{ S. Carolina (B. M. 677); } \beta. \text{ S. Carolina (B. M. 680, 681, 940).}\]

9. *C. tenella* Schrad., Nov. Gen. Pl., p. 6 (1797). This species resembles *C. intricata* in size, shape, colour, and spores. Cup one-third the height of the sporangium, or more or less obsolete. Net close, regular; nodes numerous, dark brown, rounded, rarely elongated, prominent, with few or no free rays, connected by three to six very slender threads.—Rost., Mon., p. 235; Mass., Mon., p. 58. *C. elata* Mass., Mon., p. 61.

Plate LIV., B.—*f*. sporangium after dispersion of spores, \(\times 20\); *g*. part of net of sporangium, \(\times 180\) (Ceylon: Rostafinski's type); *h*. part of net and margin of cup, \(\times 180\) (Philadelphia, U.S.A.); *i*. spore and plasmodic granules, \(\times 600\).

Both *C. tenella* and *C. intricata* are abundant in the United States, where frequent intermediate forms occur connecting them with one another. The specimen figured from Ceylon (K. 1684), referred to by Rostafinski, Mon., App., p. 31, as a type of *C. tenella*, has a small cup, rounded or elongated prominent nodes, with no free rays; it is similar to the specimens received from Dr. Rex from the United States under that name. Mr. Massee has raised it to the rank of a species as *C. elata*.

\[\text{Hab. On dead wood.—Orchid house, Lamberhurst, Kent (L:B.M.112); Ceylon (K. 1684); Philadelphia (L:B.M.112); N. Carolina (L:B.M.112).}\]
10. C. pyriformis Schrad., Nov. Gen. Pl., p. 4 (1797). Plasmodium? Total height 1 to 1·7 mm. Sporangia turbinate or globose, stipitate, erect, gregarious, 0·3 to 0·5 mm. diam., purplish-brown; cup about one-third the height of the sporangium, pale brownish-yellow, perforated and irregularly toothed at the margin, or equally toothed, beset with large round purple-brown plasmodic granules, 2 to 2·5 μ. diam., arranged in broad lines radiating from the base or evenly distributed; nodes of the net varying in shape and size, charged with dark round plasmodic granules and connected by pale brownish-yellow threads. Stalk stout or slender, 0·5 to 1 mm. high, dark purple-brown. Spores pale ochraceous or pinkish, almost smooth, 5 to 6 μ diam.—Rost., Mon., p. 237; Cooke, Myx. Brit., fig. 14; Mass., Mon., p. 55.

a. genuina: sporangia pyriform; nodes flat, polygonal, often branching; stalks stout, furrowed.

β. notabilis: (Rex, in litt.) sporangia globose; nodes convex and prominent, rounded or irregular; stalks slender.

Plate LV., A.—a. sporangia after dispersion of spores, a. genuina, × 20; b. part of net and cup of sporangium, × 180 (Shrewsbury, England); c. sporangium from mounting in Canada balsam, × 20 (Germany, Rostafinski's type); d. part of net and cup of same, × 180; e. sporangia after dispersion of spores, β. notabilis, × 20; f. g. part of net and cup of brown and dark-brown sporangia, × 180; h. spore and plasmodic granules, × 600 (United States).

The variety β. notabilis appears to be the American form of C. pyriformis; it differs from the European gatherings in the globose sporangia, the slender stalks, the delicate threads of the net, and in the nodes, which, though variable in shape, are usually prominent and convex, often approaching forms of C. tenella and C. intricata. It has been obtained from several of the American States. The abundance of plasmodic granules varies in different gatherings.

Hab. On dead fir-wood.—a. France (Paris Herb.); a. Berlin (B. M. 672); a. Germany (Strassb. Herb.); β. New York (L:B:M.113); Virginia (L:B:M.113); N. Carolina (L:B:M.113).

11. C. languescens Rex, in Proc. Acad. Nat. Sc. Phil. (1891), p. 394. Plasmodium? Total height 2·5 to 3 mm. Sporangia globose, stipitate, drooping, scattered, 0·25 to 0·35 mm. diam., dull red; cup one-third the height of the sporangium, red-brown, shining; beset with purple-brown plasmodic granules, 0·3 to 1 μ diam., arranged in close lines radiating from the apex of the stem; margin toothed; nodes of the net purplish-brown, thickened, rather prominent, charged with dark granules, polygonal, with few free rays, and slender connecting threads; meshes of the net triangular. Stalk very slender, subulate, somewhat sinuous or wavy, dark red-brown. Spores pale red, almost smooth, 5 to 6·5 μ diam.

Plate LV., B.—a. sporangia after dispersion of spores, × 20; b. part of net and margin of cup of sporangium, × 180; c. spore and plasmodic granules, × 600 (United States).
This species has hitherto been found only in America; the spores in mass are described by Dr. Rex as "dull red, the colour of the paler forms of C. purpurea."

_Hab._ On dead wood.—New York (L:B.M.114); Ohio (L:B.M.114); S. Carolina (K. 1689).

12. _C. microcarpa_ Pers., Syn., p. 190 (1801). Plasmodium? Total height 0·7 to 2 mm. Sporangia globose, gregarious, stipitate, erect or nodding, 0·2 to 0·25 mm. diam., purple-brown; cup rudimentary or wanting; net close, regular, nodes of the net subglobose, prominent, about 10 μ diam., densely charged with purple-brown plasmodic granules 1 to 2 μ diam., connected by five or six delicate pink threads. Stalk slender, four to ten times the height of the sporangium, purple-brown. Spores pale red, minutely spinulose, 5 to 6 μ diam.—Rost., Mon., p. 235; Mass., Mon., p. 63. *Cribraria capillaris* Fr., Stirp. Femsj., p. 84. *Dictydium microcarpum* Schrad., Nov. Gen. Pl. p. 13 (1797).

Plate LV., B.—d. sporangium after dispersion of spores, × 20 (d. Germany, Rostafinski’s type, e. United States); f. part of net with cup of sporangium, × 180 (Germany); g. the same, × 180 (United States); h. spore and plasmodic granules, × 600.

_Hab._ On rotten wood.—Germany (B. M. 676); Freiburg, Germany (Strassb. Herb.); Philadelphia (L:B.M.115).

13. _C. purpurea_ Schrad., Nov. Gen. Pl., p. 8 (1797). Plasmodium? Total height 2·5 mm. Sporangia globose, stipitate, erect or inclined, gregarious, 1 mm. diam., purple; cup one-third of the sporangium, margin deeply toothed; net of slender threads with mesh of varying size, about 1 mm. diam., only a few of the nodes expanded, flat, and angular; the cup and net thickly studded with round purple plasmodic granules, 2 to 2·5 μ diam. Stalk cylindrical, furrowed, 1·5 mm. long, 0·1 mm. thick, purple-black. Spores purplish, minutely warted, 5 to 6 μ diam.—Rost., Mon., p. 233; Blytt, Bidr. K. Norg., Sop. iii., p. 10; Mass., Mon., p. 57.

Plate LVI., A.—a. sporangium after dispersion of spores, × 20; b. part of net of same, × 180; c. spore and plasmodic granules, × 600 (Salzburg, Tyrol).

_Hab._ On rotten wood.—Salzburg, Tyrol (L:B.M.116); Norway (L:B.M.116 slide); Philadelphia (L:B.M.116).

14. _C. elegans_, Berk. & Curt., in Grev., ii., p. 67 (1873). Plasmodium? Total height 0·7 to 1·3 mm. Sporangium globose, stipitate, erect or inclined, gregarious, 0·3 to 0·4 mm. diam., red-purple; cup about half the height of the sporangium, with the margin deeply toothed and perforated; net of very slender threads, with numerous branching flat expansions at the nodes, the cup and nodes thickly studded with round purple plasmodic granules, 2 to 2·5 μ diam. Stalk subulate, nearly smooth, 0·6 to 1 mm. long, purple-black. Spores pale violet, almost smooth, 4 to 6 μ diam.—Rost., Mon., App., p. 31; Mass., Mon., p. 55.
Plate LVI., A.—d. sporangia after dispersion of spores, × 20; e. part of net and margin of cup, × 180; f. spore and plasmodic granules, × 600 (United States).

This species is nearly allied to C. purpurea.

Hab. On rotten wood.—New York (L:B.M.117); S. Carolina (B. M. 675, 941).

15. C. violacea Rex, in Proc. Acad. Nat. Sc. Phil. (1891), p. 393. Plasmodium "deep violet-black, in rotten wood" (Rex, l.c.). Total height 0.5 to 1 mm. Sporangia globose or ellipsoid, stipitate, erect or slightly nodding, gregarious, about 0.2 mm. diam., dark violet with a metallic sheen; cup varying in extent of development, two-thirds the height of the sporangium or more, or reduced to one-third, membranous, violet-blue, the margin scalloped with few short teeth; net of delicate threads connected with broadly expanded, flat, angular nodes; "exceptionally the apical portion is nearly entire, being simply perforated with three or four oval or rounded openings" (Rex). The cup and nodes are beset with minute purple plasmodic granules 0.5 to 1 μ diam. Stalk slender, subulate 3 to 5 mm. long, violet-black. Spores lilac, minutely and closely warty, 6 to 8 μ diam.

Plate LVI., A.—g, sporangium after dispersion of spores, × 20 (England); h, part of net and margin of cup of same, × 180; i. sporangia after dispersion of spores, × 20 (United States); k. part of net and cup of same, × 180; l. spore and plasmodic granules, × 600.

In July, 1893, and in September, 1894, fine gatherings of this beautiful and minute species were obtained by Mr. J. Saunders from the under side of a rotten fir-log near Ivinghoe, Bucks; the colour of the sporangia, stalks and spores is violet-blue, and they resemble the American specimens received from Dr. Rex in all respects except that in many cases the cup of the sporangium-wall is one-third to one-half the height of the sporangium instead of two-thirds or more. It differs from C. elegans in the longer stalks, the smaller sporangia, in the blue-, not red-purple colour, in the smaller plasmodic granules in the knots and sporangium-wall, and in the larger violet-blue spores with a thicker epispore.

Hab. On fir-wood.—Ivinghoe, Bucks (L:B.M.118); Philadelphia (L:B.M.118).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

16. C. tatrica Racib., in Hedw. (1885), p. 170. Sporangia globose, red-brown, 3/4 to 1 mm. diam., stalked; stalk dull red, straight, 2 mm. long; cup irregularly crenate-dentate, closely perforated at the margin; nodes of the net not enlarged; spores smooth, yellow, 6 to 7 μ diam.

Hab. On rotten wood.—Tatra, Hungary.

This description suggests C. aurantiaca B., in which the nodes of the net are only slightly enlarged.

C. stellata Schum., C. didermoides Schum., C. badia Chev., are excluded by Rostafinski on what appear to be sufficient grounds.
Genus 24.—**DICTYDIUM** Schrader, Nov. Gen. Pl., p. 11 (1797). Sporangia globose, stipitate; sporangium-wall formed of parallel ribs extending from the base to the apex, connected by slender transverse threads, the intervening wall evanescent.


Plate LVI., B.—a. to d. sporangia of various forms after the dispersion of the spores, × 36; a. typical form; b. form with cup; c. form with irregular net, found with sporangia of usual type (England); d. erect sporangium (United States); e. spore, × 600; f., g. type of *Heterodictyon mirabile* Rost., × 70 (Freiburg, Germany); h. spores of same, × 600.

The ribs of the sporangium-wall are inflexed at the summit in maturity, and break the wall of enclosed spores by vertical pressure; they consist of two layers, the outer smooth and shining, the inner beset with purple plasmodic granules 1 μ diam.; they are usually free at the base of the sporangium, but are sometimes connected by an irregular basal disc. A form is occasionally found with a well-developed cup having an evenly toothed margin from which the ribs take rise; associated with this character the stalk is more erect, and of a browner colour than in the usual type; the variety, however, appears to be too inconstant to be marked as distinct. A careful examination of the type specimen of *Heterodictyon mirabile* Rost., in the Strassb. Herb., leads to the conclusion that it is a form of *Dictydiurn umbilicatum*. It is no doubt a remarkable development; the basal cup is large and irregular, and the ribs in many parts are expanded and form a loose, imperfect net with broad and angular nodes; in other parts the ribs are connected by the usual delicate transverse threads, and though fewer in number and coarser than in the type, are essentially of the same character; they are thickly beset on the inner side with purple plasmodic granules, the cup is also studded with the same; the spores are precisely similar to those of
Dictydiun umbilicatum, with two to four minute purple granules on the spore wall; the stalks are stout and rugged, but of the same purple-brown colour as in the latter species. The type of Cibraria exilis Macbride, from Nicaragua (B. M. 1026), is an almost typical form of Dictydiun umbilicatum, with a shallow cup connecting the slender parallel ribs at the base.

Hab. On dead wood. — Lyme Regis, Dorset (L:B.M.119); Wanstead, Essex (L:B.M.119); Luton, Beds (L:B.M.119); Glamis, Scotland (B. M. 241); France (Paris Herb.); Germany (B. M. 660, 663); Italy (B. M. 659); Ceylon (B. M. 670); Borneo (L:B.M.119); Maine (B. M. 1105); Philadelphia (L:B.M.119); Iowa (B. M. 821); S. Carolina (B. M. 666); Nicaragua (B. M. 1026).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

2. D. venosum Schrad., Nov. Gen. Plant., p. 14, pl. iii., fig. 6 (1797). Scarcely a line high; sporangia spherical, cernuous, more or less as in D. umbilicatum, yellowish-brown, when the spores are shed, colourless; veined with nine to twelve ribs of rather a brighter colour, the final branches of the ribs lateral, usually not anastomosing; stalk slender, flexuose, brownish.

Hab. On rotten pine wood. Possibly a form of D. umbilicatum, with an irregular net.

Order II.—Liceaceæ. Sporangia solitary, sessile or stalked; sporangium-wall cartilaginous; capillitium and columellæ wanting.

KEY TO THE GENERA OF LICEACEÆ.

Sporangia sessile, globose or plasmodiocarps. (25) Licea.

Fig. 33.—Licea flexuosa Pers.
b. Plasmodiocarp. Magnified 6 times.
c. Spores. Magnified 200 times.

Sporangia stalked, furnished with a lid of thinner substance. (26) Orcadella.

Fig. 34.—Orcadella operculata Wingate.
a. Group of sporangia. Magnified 8 times.
b. Sporangium with open lid. Magnified 80 times.

KEY TO THE SPECIES OF LICEA.

A. Spores spinulose:—
   Sporangia forming elongate plasmodiocarps, spores 11 to 14 μ.
   1. L. flexuosa

   Sporangia subglobose, spores 9 to 11 μ.
   2. L. minima

B. Spores smooth, 16 to 20 μ.
   3. L. pusilla


Plate LVII., A.—a. plasmodiocarp, × 20; b. fragment of sporangium-wall and spores, × 280; c. spore, × 600 (Germany).

The spores in this species are free, and thicker and rougher on one side. There is a specimen from Capt. Carmichael, Appin, Argyle (K. 1670), named by Berkeley Licea flexuosa, and by Rostafinski Enteridium olivaceum (Mon., App., p. 30), which is a simple plasmodiocarp form without capillitium, resembling L. flexuosa, but the spores are in clusters of 6 to 8; it holds an intermediate position between the two species, which appear to be closely allied; specimens of typical aethaloid Enteridiu olivaceum are occasionally found having free spores.

Hab. On dead wood.—Aboyne, Scotland (K. 1611); Germany (Strassb. Herb.; L:B.M.120); Norway (L:B.M.120).

2. L. minima Fr., Syst. Myc., iii., p. 199 (1829). Plasmodium yellow (teste Rex). Sporangia hemispherical on a broad base, depressed, scattered, 0·2 to 0·5 mm. diam., brown or nearly black, dehiscing in lobes; sporangium-wall cartilaginous, opaque, dark brown, the margin of the lobes dotted with minute granules 1 to 2 μ diam. Spores olivaceous-brown, thicker on one side, spinulose, 9 to 11 μ diam.—Tubulina minima Mass., Mon., p. 36.

Plate LVII., A.—d. sporangia, × 20; e. spores, × 280 (Finland); f. spores, × 280 (Sweden); g. sporangia, × 20 (United States); h. fragment of sporangium-wall and spores of same, × 280; i. spore, × 600.

Hab. On dead pine-wood.—Finland (B. M. 654); Sweden (K. 1646); Norway (L:B.M.121); New York (L:B.M.121).

Plate LVIL. B.—a. sporangia, x 20; b. fragment of sporangium-wall, and spores, x 280; c. spore, x 600 (Scotland).

This species was separated by Rostafinski from *Licea*, and placed in the division *Amaurosporeae* as the type of a new genus *Protoderma*, on account of the colour of the spores. The examination of several specimens in Strassb. Herb. and British Museum shows that the colour of the spores is essentially olive-brown; Schrader’s original place for the species is therefore retained.

*Hab.* On dead wood.—Glamis, Scotland (B. M. 100); Kiel, Germany (Strassb. Herb.).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**

4. **L. variabilis** Schrad., Nov. Gen. Pl., p. 18, pl. 6, figs. 5, 6. Sporangia scattered, depressed, reddish-brown, hemispherical, ovate, oblong or flexuose, of varying shape and size; sporangium-wall thin, dehiscing above, composed of a double membrane, the outer rough, the inner smooth, shining; spores dull yellow.

*Hab.* On pine-wood, rarely on beech.

The description and figures suggest that this species was a form of *Perichaena populina* Fr., with scanty or no capillitium.

5. **L. brunnea** Preuss, Linnea, xxvi., p. 709 (1853). Sporangia gregarious, globose, subdepressed, ochraceous-brown; the wall parchment-like, breaking irregularly, evanescent above; spores minute, ochraceous, conglobate; capillitium none.

*Hab.* On pine-wood.—Hoyerswerda, Silesia.

This brief description probably refers to *Cribraria argillacea* Pers.

6. **L. incarnata** Preuss, l.c. (1853). Sporangia minute, flesh-coloured, smooth, round, somewhat depressed; spores flesh-coloured, globose.

*Hab.* On dried tincture of rhubarb.—Hoyerswerda, Silesia.

This description is too imperfect to be of value.

7. **L. antarctica** Speg., in Boletin Acad. Nac. Cienc. Cord. Arg., xi., p. 5. Sporangia in groups of from 5 to 20, rarely solitary, sessile, obovate, 0.5 to 0.7 mm. diam., smoke-brown, glabrous, smooth; wall simple, brown, rugulose; capillitium very scanty of slender, scarcely branching, papillose tubes, 1 μ thick, dull yellow-brown; spores globose, closely and minutely warted, rosy-fulvous.

*Hab.* On dead trunks of *Fagus antarctica*.

The description suggests a form of *Perichaena populina* Fr.
SPECIES EXCLUDED FROM THE GENUS.

L. caspitosa Peck. = Lindbladia Tubulina Fr.
L. Lindheimeri Berk. = Fuligo septica Gmel.
L. perreptans Berk. = Brefeldia maxima Rost.
L. rubiformis Berk. = Tubulina fragiformis Pers.
L. spermoides Berk. & Curt. = Lindbladia Tubulina Fr.


123. Orcadella operculata Wing., l.c. (1889). Plasmodium? Total height 0·4 to 0·7 mm. Sporangia urn-shaped or subglobose, stipitate, erect, scattered, 0·1 to 0·2 mm. diam., nearly black, lid flattened, circular, dull yellow, shining; sporangium-wall cartilaginous, opaque from deposits of refuse matter; lid membranous, beset with minute granules 0·5 to 1 μ diam. Stalk cylindrical, subulate, nearly black, filled with dark coarse refuse matter. Spores yellowish in mass, almost colourless and smooth, 8 to 11 μ diam.—Mass., Mon., p. 49.

Plate LVII. B.—d. sporangia, × 20; e. fragment of sporangium-wall and papillose lid, with spores, × 280; f. spore, × 600 (United States).

Hab. On dead wood.—Philadelphia (L:B:M.123).

Order III.—TUBULINACEAE. Sporangia tubular, compacted, stalked or sessile; sporangium-wall membranous, pale rufous, without granular deposits: spores minutely reticulated, 4 to 7 μ diam.

KEY TO THE GENERA OF TUBULINACEAE.

Sporangia without tubular extensions. (27) Tubulina.

Fig. 33.—Tubulina fragiformis Pers. Cluster of sporangia. Magnified 2½ times.

Sporangium-wall with tubular extensions connecting it with a hollow pseudo-columella. (28) Siphoptychium.

Fig. 36.—Siphoptychium Casparyi Rost.
a. Cluster of sporangia. Magnified 3 times.
b. Upper part of two sporangia, their walls partially removed, showing the columella. Magnified 10 times.
Sporangium-wall with tubular extensions springing from the apex, without a pseudo-columella; sporangia stalked.

(29) Alwisia.

Fig. 37.—Alwisia Bombarda Berk. & Br.

a. Three clusters of sporangia. Twice natural size.
b. Immature sporangium, showing capillitium through the transparent walls. (Drawn from a glycerine mounting.) Magnified 12 times.
c. Upper portion of three capillitium threads, showing attachment to the sporangium-wall. Magnified 70 times.


KEY TO THE SPECIES OF Tubulina.

Sporangia clustered on a broad hypothallus, spores 5 to 8 μ.

1. T. fragiformis

Sporangia clustered on a stalk-like hypothallus, spores 3 to 5 μ.

2. T. stipitata


Plate LVIII., A.—a. tubular sporangia clustered on a spongy barren base, × 3; b. spores; in two the side is shown on which the reticulation is imperfect, × 600 (England); c. part of a cluster of sporangia with conical summits, × 3 (United States).

On examination of the sporangium-wall with a high magnifying power, it is seen to be more or less beset with minute papilae; small pouches may also be occasionally observed extending inwards to a greater or less degree, which in some forms are produced into tubes
passing across the sporangium or taking an oblique course; this appearance indicates a tendency in the direction of the marked development of tubular processes in Siphoptychium. The substance of the sporangium-wall varies in different gatherings; it may be delicately membranous, or firm and of considerable thickness. There is also some variation in the shape of the upper portion of the sporangium; in some American specimens of the more fragile type the apex is produced into a sharp cone; in others the sporangia are cylindrical, obtuse, and but slightly connected with each other, those on the outside of the cluster being often entirely free; in the stouter type the walls are closely compacted, their apices forming a level tesselated surface.

A full account of the forms of Tubulina and their relation to Siphoptychium is given by Dr. Rex, l.c. T. speciosa Specg. (Nov. Add. ad Myc. Ven., No. 123), from N. Italy, appears from the description to be T. fragiformis, but no mention is made of the size of the spores.

_Hab._ On dead wood.—Bowood, Wilts (B. M. 302); Penzance, Cornwall (B. M. 303); Luton, Beds (L:B.M.124); Clifton, Nottinghamshire (B. M. 1103); Wales (B. M. 9, 10); France (Paris Herb.); Germany (B. M. 656); Poland (Strassb. Herb.); Finland (B. M. 655); India (K. 1650); Java (B. M. 1104); Japan (K. 1649); Java (B. M. 1104); Australia (K. 1653); Philadelphia (L:B.M.124); Iowa (B. M. 823); S. Carolina (K. 806).

2. _T. stipitata_ Rost., Mon., p. 223 (1875). Plasmodium white or colourless (teste Rex). Sporangia in shape, size, and colour as in _T. fragiformis_, usually clustered on a dark brown spongy hypothallus, which has the form of a stout common stalk 2 to 3 mm. high. Spores pale rufous-brown, minutely reticulated over the greater part of the surface, the remaining part smooth or marked with ridges, 3 to 5 μ diam.—Cooke, Myc. Brit., fig. 2; Rex, in Bot. Gaz., xv., p. 318; Mass., Mon., p. 38. _Licea stipitata_ Berk. & Rav., in Journ. Linn. Soc., x., p. 350 (1868).

Plate LVIII., A.—d. cluster of sporangia on a stalk-like base, × 3; e. spores; one shows the side on which the reticulation is imperfect, × 600 (United States).

Dr. Rex considers _T. stipitata_ a distinct species from _T. fragiformis_, specially marked by the smaller spores. The stalk is a less important character, for he states that sessile clusters are not uncommon. The conical form supplied by him and referred to under _T. fragiformis_ has spores measuring 4 to 6 μ, and may represent an intermediate form.

_Hab._ On dead wood.—Bonin Islands (K. 821); Philadelphia (L:B.M. 125); S. Carolina (B. M. 538, 929, 946); Cuba (B. M. 539).

**SPECIES EXCLUDED FROM THE GENUS.**

- _T. coespitosa_ Mass. = _Lindbladia Tubulina_ Fr.
- _T. effusa_ Mass. = _Lindbladia Tubulina_ Fr.
- _T. minima_ Mass. = _Licea minima_ Fr.
- _T. spermoideas_ Mass. = _Lindbladia Tubulina_ Fr.
The type specimen of *Tubulina guaranitica* Mass. (Mon., p. 39), from Guarapi, Argentine Republic, does not belong to the Mycetozoa; it consists of stalked heads composed of a densely interwoven tissue of brown septate branching hyphae, bearing numerous amber spores, 2 to 7 µ diam., in the upper part; it belongs to the *Hyphomycetes*.

*Siphoptychium* is also a *Hyphomycetous fungus*, *Sepedonium chrysospermum* Link.

Genus 28.—**SIPHOPTYCHIUM** Rostafinski, Mon., App., p. 32 (1876). Sporangia cylindrical, closely compacted on a common hypothallus, provided with a central tubular columella connected with the sporangium-wall by straight radiating hollow processes.

1. **S. Caspary** Rost., l.c. (1876). *Plasmodium* white, on rotten wood (teste Rex). Sporangia in shape, size, and colour as in *Tubulina fragiformis*, differing in being provided with the central columella described in the genus. Spores pale rufous-brown, closely reticulated over the greater part of the surface, loosely reticulated over the remaining part, 6 to 7 µ diam. Rex, in Bot. Gaz., vol. xv., p. 319; Mass., Mon., p. 89.

Plate LVIII., A.—f. portion of two sporangia with their walls partially broken away, showing the pseudo-columella and capillitium, × 20; g. portion of pseudo-columella and capillitium, × 80; h. spores; two show the side on which the reticulation is lax, × 600 (United States).

Dr. Rex is of opinion that the columella in *Siphoptychium* may be viewed as an aborted sporangium, and adds, "Æthalia are found in which from one-third to one-half of the component sporangia lack both columellas and connecting threads" (l.c., p. 319).

The species has been found by Dr. Rex on the Adirondack Mountains, N.Y., in large quantity, but it is doubtful whether it has been obtained elsewhere. It is so nearly allied to *Tubulina fragiformis* that it is a question whether the presence of the pseudo-columella is a character of sufficient importance to justify a generic distinction.


Genus 29.—**ALWISIA** Berkeley & Broome, in Journ. Linn. Soc., xiv., p. 86 (1873). Sporangia cylindrical, stipitate, the stalks combined in clusters; capillitium represented by tubular extensions of the sporangium-wall springing from the apex of the sporangium.

1. **A. Bombarda** Berk. & Br., l.c., p. 87 (1873). *Plasmodium?* Total height 4 mm. Sporangia cylindrical-ellipsoid, stipitate, clustered, 1 to 1'5 mm. high, 0'5 mm. broad, rufous-brown; sporangium-wall membranous, pale red, beset with minute scattered papille on the inner side, and occasionally produced into small pouches. Stalks cylindrical, 2'5 mm. high, 0'12 mm. thick, closely adhering in clusters of 4 to 12, brownish-purple; when mounted in glycerine orange-red. Capillitium consisting
of numerous irregular, tubular threads, 0.5 to 1 mm. long, 3 to 18 μ wide at their origin at the apex of the sporangium, whence they radiate downwards, tapering and branching at a wide angle below, the slender extremities attached to the wall about halfway down the sporangium; pale red, beset with minute scattered papillae. Spores pale red, closely reticulated over the greater part of the surface, the remaining part loosely reticulated, 5 to 6 μ diam.—Mass., in Journ. R. Micr. Soc. (1889), p. 349. Trichia fragilis Rost., Mon., App., p. 39 (in part). Prototrichia Bombardu Mass., Mon., p. 128.

Plate LVIII., B.—a. clusters of sporangia, × 2; b. cluster of sporangia, × 20; c. immature sporangia, from a mounting in glycerine, showing, through the walls, the capillitium threads arising from the apex of the sporangium, × 20; d. fragment of upper sporangium-wall, from which three capillitium threads proceed, only a small part of the thread shown, × 280; e. fragment of sporangium-wall to which the lower end of a branching capillitium thread is attached, × 280; f. spores, × 600 (Ceylon).

This species is represented by a single gathering in July 1868 by Thwaites from Ceylon. The sporangia are to a large extent immature, purplish, and with the spores imperfectly developed, but a few are nearly mature and show the rufous-brown colour described above. Although the character of the long clustered stalks is peculiar, the colour and texture of the sporangium-wall, and the colour, size, and markings of the spores are similar to what is seen in other members of the Tubulineae, while the threads of the capillitium find a close analogy in the tubular extensions of the sporangium-wall of Siphophytychium.

Hab. On Jungermannia, growing on decayed wood.—Gongolla Forest, Ceylon (B. M. 1000).

Order IV.—Reticulariaceae. Sporangia combined into an æthalium; sporangium-walls incomplete, perforated, or forming a spurious capillitium.

KEY TO THE GENERA OF RETICULARIACEÆ.

Sporangium-wall cap-shaped at the apex, continued down to the hypothallus in four to six straight threads.

(30) Dictydiæthalium.

Fig. 38.—Dictydiæthalium plumbeum Rost.

a. Æthalium. Natural size.

b. Eight sporangia of an æthalium isolated; in three the column of spores has fallen away, leaving the cap and persistent threads. Magnified 20 times.
Walls of convoluted sporangia perforated and forming a uniform tissue of interarching bands.

Fig. 39.—Enteridium olivaceum Ehrenb.
b. Part of spurious capillitium. Magnified 35 times.
c. A spore cluster, and one isolated spore. Magnified 210 times.

Walls of convoluted sporangia incomplete, forming tubes and folds with numerous anastomosing threads.

Genus 30.—**DICTYDÆTHALIUM** Rostafinski, Versuch, p. 5 (1873). Æthalium flat, formed of erect columnar sporangia; sporangium-wall dome-shaped at the apex, continued down to the hypothallus in four to six straight threads; capillitium none. **CLATHROPTYCHIUM** Rost., Mon., p. 225 (1875).

1. **D. plumbeum** Rost., l.c., p. 5 (1873). Plasmodium rose-red, in rotten wood. Æthalium 1 to 3 cm. broad, 0.5 to 1 mm. thick, dull slate-coloured or clay-coloured, iridescent, areolated with the convex apices of the sporangia; sporangia cylindrical, angled by mutual pressure, 0.5 to 1 mm. high, 0.2 mm. thick; sporangium-wall persistent and dome-shaped at the apex, subcartilaginous, continued down to the hypothallus in four to six straight threads, 2 to 4 μ thick, triangular in section; evanescent between the threads. Spores clay-coloured or yellow in mass, when magnified pale yellow, spinulose, 9 to 12 μ diam.—**Fuligo plumbea** Schum., Enum. Pl. Sæll., ii., p. 193 (1803). **Reticularia plumbea** Fr., Syst. Myc., iii., p. 88. **Licea rugulosa** Wallr., Comp. Fl. Germ., iv., p. 345 (1833). **Clathroptychium rugulosum** Rost., Mon., p. 225, App., p. 30; Cooke, Myx. Brit., p. 55; Blytt, Bidr. K. Norg., Sop. iii., p. 9; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 117; Mass., Mon., p. 51. **Licea applanata** Berk., in Hook., Journ. Bot.

Plate LXXVI., B.—a. part of an æthalium seen from above, \( \times 20 \); b. tubular sporangia from an æthalium; in two of them the spores are dispersed and the caps and threads of the sporangium-walls are left free, \( \times 20 \); c. sporangia from a stouter æthalium, \( \times 20 \); d. cap and threads of sporangium-wall, \( \times 50 \); e. hypothallus, areolated with the bases of the sporangia, \( \times 50 \); f. spores and portion of a thread, \( \times 280 \); g. spores and portion of thread from æthalium drawn at c., \( \times 280 \) (England); h. spore and thread from a stout æthalium, \( \times 280 \) (Sikkim, K. 1669); i. spore, \( \times 600 \) (England); k. spore from type of Clathroptychium Berkeleyi Mass., \( \times 600 \).

The spores are dispersed by the threads giving way at the base and the sporangia separating in tufts from the persistent shining hypothallus. American specimens have been received from Dr. Rex which show an abnormal development; the sporangium-wall is, to a great extent, continuous between the threads, and forms a lattice-work with wide expansions. An unusually stout form has been obtained from Sikkim (K. 1669), and named Reticularia entoxantha by Berkeley, but referred by Rostafinski to Clathroptychium rugulosum, l.c.; it is an olive-black æthalium, 3 mm. thick, and bright yellow within; the threads of the sporangia are 10 \( \mu \) diam., waved and thickened at the margins; the spores are yellow and spinulose, 9 to 11 \( \mu \). Clathroptychium Berkeleyi Mass., from Ceylon (K. 1666), differs only from the robust forms of D. plumbeum in the more strongly spinulose spores; but as the spores of most gatherings vary in the amount of roughness, this character alone is not sufficient to mark specific difference. Clathroptychium cinnabarinum Sacc., in Michelia, i., p. 545, is said to have vermilion sporangia, with blackish-purple opercula and threads; this description applies to immature specimens of D. plumbeum.

Hab. On dead wood.—Nadloc, Wilts (B. M. 20); Batheaston, Somerset (B. M. 292, 299); Luton, Beds (L:B.M.128); France (Paris Herb.); Germany (Strassb. Herb.); Hungary (K. 828); Ceylon (K. 1664); Sikkim (K. 1669); Australia (K. 834); Philadelphia (L:B.M.128); New Jersey (B. M. 945); S. Carolina (B. M. 928, 947).

Species not met with in the quoted collections.

2. D. dissiliens Hazslinszky, in Oester. Bot. Zeitsch., xxvii., p. 85 (1877). Peridia pulvinate, round or oval, 2 to 5 mm. diam.; external wall chestnut-brown, dull pruinose; the inner wall, together with the spores and elaters, yellow-brown. Spores 8 to 10 \( \mu \).

Hab. On willow.—Hungary. The mature peridium bursts elastically, and the elaters then become three times longer.

KEY TO THE SPECIES OF ENTERIDUM.

Spores warty, clustered.  
E. olivaceum

Spores reticulated, free.  
E. Rozeanum


Plate LIX., A.—a. aethalium, half natural size; b. perforated sporangium-walls, and spore clusters, \( \times 80 \); c. spore cluster, \( \times 600 \) (England).

Intermediate forms occur between E. olivaceum and Licea flexuosa (see note, p. 150), which indicate an alliance between the two species.

Hab. On dead wood.—Ascot, Berks (B. M. 14, 15, 16); Kent (B. M. 13); Boynton, Yorkshire (B. M. 1158); Glen Tanner, Scotland (K. 1670); Poland (Strassb. Herb.); New Jersey (K. 835).


Plate LIX., A.—d. aethalium; half is seen in vertical section, showing the persistent sporangium-walls and the barren base, \( \times 3 \); e. perforated sporangium-walls, \( \times 80 \); f. spores, \( \times 400 \) (United States).

Mr. Wingate states that specimens received by him from M. Roze, of Paris, identify the American gatherings with Reticularia Rozeana Rost.

Hab. Philadelphia (L:B.M.130); Ohio (L:B.M.130); Iowa (L:B.M. 130).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

3. Enteridium Rostrupii Raunk., in Bot. Tidssk, xvii., p. 106 (1888). Aethalium irregularly extended, 4 cm. broad, composed of one layer of sporangia, 1 mm. high; olive-green, the side walls of the sporangia perforated with large oval openings. Spores in
oval or spherical clusters of 5 to 25, warted on the exposed surface, elsewhere smooth, 11 to 12 μ.

_Hab._ On fir wood.—Denmark.

This appears to be a form of _E. olivaceum_ intermediate between the usual type and the simple type from Glen Tanner referred to under _Licea flexuosa._

4. _E. macrosperma_ Raunk., _l.c.,_ is described as similar to _E. olivaceum_, but the spores are spinulose on the outer surface and 12 to 14 μ diam.

_Hab._ On fir.—Denmark.

It is very doubtful if the slightly larger size and more spinulose markings of the spores is a sufficient character on which to base specific difference.

Genus 32.—_RETICULARIA_ Bulliard, Champ., p. 95 (1791). _Æthalium_ composed of numerous elongated interwoven sporangia, with their walls partly evanescent, partly persistent, forming chambers and strands, and dividing above into delicate capillitium-like threads; spores and threads rusty-brown.

**KEY TO THE SPECIES OF _RETICULARIA._**

| Spores minutely reticulated. | 1. _R. Lycoperdon_ |
| Spores coarsely reticulated. | 2. _R. lobata_ |

1. _R. Lycoperdon_ Bull., _l.c.,_ t. 446, f. 4 (1791). Plasmodium creamy-white, on dead wood. _Æthalium_ pulvinate or subglobose, 2 to 6 cm. diam., enclosed in a thin smooth silvery cortex, seated on a well-developed hypothallus of interwoven membranous strands. Capillitium consisting of the persistent remains of the sporangium-walls, forming irregular chambered and branching strands arising from the hypothallus, dividing above into numerous delicate flattened and flexuose threads; together with the spores pale rusty-brown. Spores somewhat turbinate, thickened and closely reticulated on the rounded side, the remaining part marked with scattered warts, 6 to 8 μ diam.—Rost., Mon., p. 240; Cooke, Myx. Brit., p. 60; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 10; Mass., Mon., p. 93. _Reticularia umbrina_ Fr., Syst. Myc., iii., p. 87. _R. argentea_ Corda, Ic. Fung, vi., p. 15.

Plate LIX., B.—_a._ æthalia, half natural size; _b._ capillitium, × 80; _c._ spores, × 600 (England).

In æthalia developed in a moist atmosphere under a glass shade the silvery cortex formed by the drying of the outer ends of the sporangia is not produced, but the convolute sporangia are filled with spores to their apices, which gives an irregular brain-like surface to the æthalia. In some gatherings the walls of the sporangia are much more persistent than in others, and have almost the character of _Enteridium_, to which genus _Reticularia_ is closely allied.

_Hab._ On dead wood.—Bristol (B. M. 18); Leytonstone, Essex (L:B.M.131); Germany (Strassb. Herb. and B. M. 649); Sweden (K. 977).
2. **R. lobata** Lister. Plasmodium watery-white, in decayed wood. Æthalia small, consisting of irregularly clustered and confluent sporangia, or spreading over the substratum in flattened lobes about 0.5 mm. diam., shining, iridescent, rusty-brown; walls of the æthialium membranous, soon evanescent; sporangium-walls within the æthialium rising from the hypothallus in membranous folds and merging into a scanty network of more or less delicate flattened threads; together with the spores rusty-brown. Spores sharply reticulated on two-thirds of the surface, faintly and irregularly reticulated on the remaining third, 6 to 10 μ diam. *Reticularia Rozeana* List., in Journ. Bot. (1891), p. 263 (non Rost.).

Plate LIX., B.—d. æthalium, × 10; e. capillitium, × 80; f. spores, × 600 (England).

This species has been gathered in four consecutive years on a Spanish chestnut stump in Wanstead Park, Essex; it has been found near Woking and at Leighton Buzzard, and has also been collected by Mr. Camm near Birmingham. Examples of the form were submitted to Dr. Rex, who compared them with American gatherings of *Enteridium Rozeanum* Wing., and pronounced it to be a new species distinguished by the *Reticularia* character of the æthalia and by the more uniformly reticulated spores. Specimens of *E. Rozeanum*, from Philadelphia, Ohio, and Iowa, confirm the opinion of Dr. Rex, and correct my notice in the Journal of Botany (l.c.) giving the English gatherings as "*Reticularia Rozeana* Rost.," but the two species are closely allied.

*Hab.* On dead wood.—Wanstead, Essex (L:B.M.132); Leighton, Beds (L:B.M.132); Woking, Berks (L:B.M.132); Birmingham (L:B.M.132).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**


*Hab.* On palm leaves.—Ceylon.

**SPECIES EXCLUDED FROM THE MycetoZoa.**


Subcohort III.—**CALONEMINEÆ.** Sporangia simple, except in *Lycogala*; capillitium always present, forming a system of uniform threads; spores yellow, red, or grey.

Order I.—**TRICHIACEÆ.** Capillitium consisting of free elaters, or combined into an elastic network, with thickenings in the form of spirals or complete rings.
KEY TO THE GENERA OF TRICHIACEÆ.

Capillitium abundant, consisting of free elaters with spiral thickenings.  

(33) Trichia.

Fig. 41.—Trichia affinis de Bary.

b. Elater. Magnified 250 times.
c. Spore. Magnified 400 times.

Capillitium scanty, consisting of free elaters with imperfect spiral thickenings; sporangia minute, heaped.  

(34) Oligonema.

Fig. 42.—Oligonema nitens Rost.

a. Cluster of sporangia. Magnified 3 times.
b. Elater. Magnified 280 times.
c. Spore. Magnified 400 times.

Capillitium combined into a network, with spiral thickenings.  

(35) Hemitrichia.

Fig. 43.—Hemitrichia rubiformis Lister.

b. Capillitium. Magnified 280 times.
c. Spore. Magnified 400 times.

Capillitium combined into a network, with thickenings in the form of rings.  

(36) Cornuvia.

Fig. 44.—Cornuvia Serpula Rost.

a. Plasmodiocarp. Magnified 7 times.
b. Capillitium. Magnified 260 times.
c. Spore. Magnified 400 times,
Genus 33.—**TRICHLA** Haller, Hist. Stirp. Helv., iii., p. 114 (1768). Sporangia stalked or sessile; sporangium-wall membranous, sometimes charged with granular matter; capillitium yellow or brown, consisting of free elastic threads, pointed at each end, and thickened with two to five spiral bands; spores reticulated, or minutely warted.

**KEY TO THE SPECIES OF TRICHLA.**

A. Spores reticulated, or marked with broken bands:—

1. Elaters 7 to 8 μ wide, spores reticulated, border 2 μ wide.

   1. **T. favoginea**

   Elaters 4 to 5 μ wide, spores reticulated with narrow bands, border 1 μ wide, sporangia stalked.

   2. **T. verrucosa**

   Elaters 4 to 6 μ wide, spores reticulated with broad pitted bands, border 0·5 to 1 μ wide, sporangia sessile.

   3. **T. affinis**

   Elaters 4 to 6 μ wide, spores with broken reticulation of broad pitted bands, border 0·5 μ wide, sporangia sessile.

   4. **T. persimilis**

   Elaters 4 to 6 μ wide, spores very closely reticulated, border none, sporangia sessile.

   5. **T. scabra**

B. Spores minutely warted:—

   6. **T. varia**

   a. Spirals of elaters two.

   b. Spirals of elaters three or more—

      a. Elaters shortly tapering at the ends—

         Sporangia sessile, wall uniformly thickened with granular matter; elaters smooth or spinulose.

         7. **T. contorta**

         Sporangia stalked, wall membranous, with rounded areas thickened with granular deposits; elaters spinose.

         8. **T. erecta**

         b. Elaters smooth, very gradually tapering at the ends—

         Stalk hollow, filled with spore-like cells.

         9. **T. fallax**

         Stalk solid.

         10. **T. Botrytis**

1. **T. favoginea** Pers., in Röm., N. Mag. Bot., i., p. 90 (1794). Plasmodium? Sporangia globose, ovoid, or clavate, crowded, sessile or shortly stalked, on a membranous hypothallus; 0·6 to 0·7 mm. broad, 0·7 to 1·9 mm. high, ochraceous-yellow; mass of spores and capillitium orange-yellow; sporangium-wall membranous, minutely thickened with irregular strie. Stalk membranous, rarely present. Capillitium of long cylindrical elaters 7 to 8 μ diam., smooth or with scattered spines, thickened

Plate IX., A.—a. sporangia, × 20; b. elater, × 600; c. spore, × 600 (Freiburg, Germany).

The species of *Trichia* with reticulated spores are separated from each other by somewhat arbitrary lines, owing to the inconstancy of the distinctive characters. The descriptions under the several names are here given from the type specimens in the Strassb. Herb.; they represent well marked centres, but in this abundant and widespread genus forms are of frequent occurrence which take an intermediate position. The character of longitudinal striae connecting the bands on the elaters is met with to a greater or less extent in each member of the group. In extensive gatherings on old pine stumps in the Black Forest, the elaters are nearly regular in breadth, usually 8 μ diam., but some measure 7 μ and some 6½ μ; the connecting striae are almost always but not invariably distinct; the spores have mostly unbroken bands without pits, and show a border 2 μ diam.; in some parts of several gatherings the bands are broader, broken and pitted, and the border reduced to a slight thickening of the spore-wall: but in all these specimens a considerable part retains the character of *T. favoginea* in the narrow and even bands on the spores and broad elaters. American gatherings show similar variation; sometimes with spores having regular reticulation and narrow bands, the elaters are only 6 μ diam. Between *T. affinis* and *T. persimilis*, and between *T. persimilis* and *T. scabra*, intermediate forms frequently occur where it is often difficult to decide under which head to place them. The length and markings of the elaters is also a varying character. A gathering of *Hemitrichia chrysospora* List. has been found at Lyme Regis of the *Trichia* form with free elaters; *T. scabra* has occurred with the capillitium consisting of a dense network of the extreme Hemitrichia type, with no free elaters; *T. affinis* and *T. scabra*, when exposed to severe changes of temperature, at the time of their fruiting, have developed elaters with the spirals to a great degree modified into complete rings, approaching the markings on the elaters of *Cornuvia Serpula*; and *T. persimilis* under similar conditions has produced very short elaters with broad rings and faint spirals with much the same character as *Oligonema nitens*. With such blending of form, which indicates a relationship between all these species, the characters given in the key must be taken as approximate, and mark the main centres around which the numerous varieties group themselves.
TRICHIAE.  

Hab. On dead wood.—Bulstrode, Buckinghamshire (B. M. 1114); Sutton, Warwick (L:B.M.133); Baden Baden (L:B.M.133); Salem, Germany (B. M. 777, 783); Switzerland (B. M. 1140); Sweden (K. 1179); Poland (Strassb. Herb.); Philadelphia (L:B.M.133).

2. T. verrucosa Berk., in Hook., Fl. Tasm., ii., p. 269 (1860). Plasmodium? Total height 2 to 4 mm. Sporangia pyriform or clavate, stipitate, clustered or solitary, 1·4 mm. high, 0·8 mm. broad, ochraceous-yellow, mass of elaters and spores golden-yellow; sporangium-wall membranous, minutely and closely papillose, pale yellow. Stalks membranous, 1 to 2 mm. high, usually combined in clusters of three or four, rugose, yellow-brown, or dark brown. Capillitium of long cylindrical elaters, 4 to 6 μ wide, with short conical ends, marked with three to five narrow spiral bands, smooth, or with a few scattered spines, longitudinal striae distinct. Spores reticulated with narrow, minutely pitted bands, forming a network with about seven meshes to the hemisphere, 13 to 16 μ diam., border 1 μ wide.—Mass., Mon., p. 191. T. superba Mass., in Journ. R. Micr. Soc. (1889), p. 345; Mass., Mon., p. 194.

Plate LX., B.—a. sporangia, × 20; b. elater, × 600; c. spore, × 600 (New Zealand).

The specimen from Tasmania (K. 1750) described by Berkeley as T. verrucosa is somewhat immature, but is sufficiently developed to be clearly identified as the same species as T. superba Mass. from New Zealand. A fine specimen of the same form from Chili, in the Strassburg Herb., is named by Rostafinski T. chrysosperma. It is no doubt closely allied to that species, but the constancy of the characters of the stalked sporangia and of the spores marked with a rather close reticulation of narrow bands forming a border scarcely 1 μ broad supports the specific distinction. A large gathering by Prof. Balfour in Scotland shows the same characters.

Hab. On dead wood.—Moffat, Scotland (L:B.M.134); Tasmania (K. 1750, 1751); New Zealand (K. 1166, 1167, 1764); Chili (Strassb. Herb.).

3. T. affinis de Bary, in Fückel, Symb. Myc., p. 336 (1869). Plasmodium watery-white, in dead wood. Sporangia globose, sessile, crowded on a membranous hypothallus, 0·6 to 1 mm. diam., shining golden or ochraceous-yellow; mass of elaters and spores bright yellow; sporangium-wall membranous, pale yellow, marked with delicate irregular striae. Capillitium of long cylindrical elaters, 4 to 6 μ diam., with conical pointed ends, marked with four to five spiral bands, smooth, or with minute scattered spines; longitudinal striae usually present, but often faint. Spores reticulated with broad, rarely narrow, pitted bands, forming a more or less complete net with three to five meshes to the hemisphere, 13 to 15 μ diam., border 0·5 to 1 μ wide.—Rost., Mon., p. 257; Cooke, Myx. Brit., fig. 241; Bullett, Bidr. K. Norg., Soc. iii. (1892), p. 13; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 131; Mass., Mon., p. 194. Trichia Kalbreyeri Mass., in Journ. R. Micr. Soc.

Plate LX., B.—d. elater, × 600; e. spore, × 600 (England).

*T. pulchella* Rex differs from the usual developments of *T. affinis* in the more scattered habit of growth of the sporangia; the elaters are narrow, being 3·5 to 4·5 µ diam.; the spores have a border 1 µ wide and are reticulated with narrow, minutely pitted raised bands, presenting from three to four meshes on the hemisphere; it can hardly be considered as having distinctive specific characters. The type specimen of *T. Kalbreyeri* Mass., from New Granada (K. 1196), has elaters 5 µ diam., with delicate longitudinal striae, and spores marked with a rather close reticulation of broad, faintly pitted bands; it does not appear to differ from typical *T. affinis*. The type specimen of *T. intermedia* Mass. from Scarborough has elaters 4 to 6 µ diam., and is almost identical with de Barry's type of *T. affinis* in the Strassburg Herbarium both in capillitium and spores.

*Hab.* On dead wood.—Addington, Surrey (B. M. 362); Leicestershire (B. M. 363); Heydon (B. M. 1115) and Wanstead, Essex (L:B.M.135); Lyme Regis, Dorset (L:B.M.135); Cotterel, Cheshire (B. M. 1125); Edinburgh (K. 1180); Germany (B. M. 785 and Strassb. Herb.); Australia (L:B.M.135); Philadelphia (L:B.M.135); Iowa (B. M. 834); S. Carolina (B. M. 959); Cuba (K. 1118); New Granada (L:B.M.135 slide); Chili (Paris Herb).


Plate LX., A.—g. elater, × 600; h. spore, × 600 (England).

A type specimen from Finland, from Dr. Karsten, agrees essentially with the examples of *T. Jackii* Rost. in Strassb. Herb.; the latter name must therefore be dropped as being antedated. The occurrence of the long spinous processes on the elaters, noted in the original description of *T. persimilis*, is not a constant character.
A form with the ends of the elaters obtuse, and the spiral bands continued at the apex into widely diverging spines, has been named *T. abrupta* Cooke, but this character is also found occasionally in *T. favoginea*, *T. affinis*, and *T. scabra*. *T. prozinella* Karsten and *T. sulphurea* Mass. have elaters 4.5 to 5 μ diam., and spores with the bands much broken; *T. Balfouri* Mass. has the elaters 4 to 5 μ diam., and the reticulation on the spores consists of wide, broken and pitted bands. They present no character by which they can be separated from *T. persimilis*.

*Hab.* On dead wood, leaves, etc.—Batheaston, Somerset (B. M. 367); Penzance (B. M. 370); Epping Forest, Essex (L.B.M.136); Lyme Regis, Dorset (L.B.M.136); Boynton, Yorkshire (B. M. 1125); Glamis, Scotland (B. M. 369); Germany (Strassb., Herb.); France (K. 1183); Finland (L.B.M.136 slide); Cape (K. 1047); Ceylon (K. 1749); Java (K. 1755); Philadelphia (L.B.M.136).


Plate LX. A.—d. sporangia, × 20; e. & f. elaters, × 600; f. spore, × 600 (England).

The type of *Arcyria Buchnalli* Mass., from Bristol (K. 1774), is an interesting form of *T. scabra*; the capillitium is spinose, and consists of long, sparingly branched free elaters, not combined into a network; the spiral bands are in many parts entirely modified into rings, a character which is often seen in a less degree in imperfect developments of this species; the spores are of the typical form of *T. scabra*. The specimen from Luton (L.B.M.137) has the dense net of a *Hemitrichia* and no free elaters; the close and rugged spirals on the threads have in some parts an annular arrangement; it is, however, an undoubted form of *T. scabra* with typical spores. The type of *T. minima* Mass., from Oldham (K. 1044), has spinulose elaters 4 to 5 μ diam.; the spores measure 9 μ, some are delicately reticulated, in others the net is broken into warts and short bands; it is not an unusual form of *T. scabra*. A type specimen of *T. nitens* (K. 1104) has spores 9 to 10 μ diam., for the most part delicately reticulated, but some have the bands much broken; the elaters measure 4 to 5 μ diam., with regular spiral
bands and only a few short scattered spines; it appears to be a typical form of *T. scabra*, except that the elaters are rather more smooth than usual.

*Hab.* On dead wood.—Wotherpe, Northamptonshire (B. M. 366); St. Catherines, Somerset (B. M. 368); Wanstead, Essex (L.B.B.M.137); Lyme Regis, Dorset (L.B.M.137); Luton, Beds (L.B.M.137); Germany (B. M. 779); Sweden (K. 1104); Poland (Strassb. Herb.); Philadelphia (L.B.M.137); Iowa (B. M. 835); Ohio (L.B.M.137).


Plate LXI., A.—a. sporangia, × 20; b. elater, × 600; c. spore, × 600 (England).

Sporangia with longer or shorter stalks often occur with sessile forms arising from the same plasmodium.

*Hab.* On dead wood.—Batheaston, Somerset (B. M. 361); Leicester-shire (B. M. 379); Lyme Regis, Dorset (L.B.M.138); Hampstead (B. M. 1122) and Highgate, London (B. M. 1120); Brandon, Suffolk (B. M. 1121); Bud's Clough, Cheshire (B. M. 1117); France (Paris Herb.); Germany (B. M. 768); Switzerland (B. M. 1141); Finland (K. 1124); Italy (K. 1148); Philadelphia (L.B.M.138); Iowa (L.B.M. 138); S. Carolina (B. M. 800).

7. **T. contorta** Rost., Mon., p. 25 (1875). Plasmodium watery-white, in bark and rotten wood. Sporangia subglobose, sessile, crowded or scattered, 0'5 to 0'8 mm. diam., or forming elongated curved plasmodiocarps, dull yellow-brown or dark red-brown; mass of spores and elaters yellow or ochraceous; sporangium-wall charged with brown granular matter. Capillitium of irregularly cylindrical threads, with indistinct or rugged spiral thickenings, or of equal elaters with four or five distinct closely set spiral bands, 3 to 5 μ diam., the tips usually swollen and ending in a curved point, yellow or yellow-brown. Spores yellow, minutely spinulose, 10 to 14 μ diam.—Cooke, Myx. Brit., fig. 229; Mass., Mon., p. 182. *Lycogala contortum* Ditm., in Sturm, Deutsch. Fl., iii., p. 8, tab. 5 (1813). *Hemitrichia contorta* Rost., in Fuckel, Sym. Myc., Nachtr., p. 75. *Trichia inconspicua* Rost., Mon., p. 259; Blytt, Bidr. K. Norg., Supp. iii. (1892), p. 13; Macbride, in Bull. Nat.

a. genuina: elaters more or less uneven from constriictions and irregular swellings, with indistinct or rugged spiral thickenings.

β. inconspicua: elaters evenly cylindrical, usually swollen behind the gradually tapering pointed ends; spiral bands distinct, regular, delicate.

γ. lutescens: sporangia yellow, subglobose; sporangium-wall membranous; elaters smooth with faint spirals.

Plate LXI., B.—a. a. genuina, sporangia, × 20; b. sporangium-wall and spores, × 280; c. elaters, × 600; d. spore, × 600 (England); e. β. inconspicua, sporangia, × 20; f. elater, × 600 (Switzerland; one of Rostafinski’s types).

Although the two varieties are well contrasted, intermediate forms are of frequent occurrence, and the variations of capillitium described above have on several occasions been found represented in different sporangia of the same group. T. inconspicua cannot therefore be regarded as a distinct species. T. reniformis Peck, of which a typical specimen has been received from Dr. Rex, has the granular thickening of the sporangium-wall and the rugged irregular spirals of T. contorta var. genuina. A type specimen of T. Andersonii Rex is very similar to the last in the form of the capillitium, but the brown granules in the sporangium-wall are less abundant. Associated with all varieties of capillitium, the wall in English gatherings may either be densely charged with brown granules resembling the structure in Perichaea corticalis, or it may be similar to that in T. Andersonii; the difference in colour between spores and capillitium mentioned by Dr. Rex in his description of this species (l.c.) is also a varying character, and it is difficult to separate the form from T. contorta. The type of T. advenula Mass., from Glamis (K, 1748), has the sporangium-wall charged with brown granular matter; the spirals on the elaters are regular and distinct; it is similar to Rostafinski’s type of T. inconspicua in Strassb., Herb. T. heterotrichia Balf., from Currey’s collection (K, 1066), appears to be an immature specimen of T. contorta var. genuina; the sporangium-walls are almost free from granular deposits; the elaters are 4 to 5 μ diam., marked with one or three rugged or indistinct spiral bands, and scattered blunt spines; the spores adhere to one another, and are very faintly minutely spinulose; they measure 12 to 13 μ. T. Iowensis Macbride (l.c.) agrees with T. contorta in the habit and colour of the sporangia, in the granular sporangium-wall, and in the spores; the elaters are 3 μ diam., and, in addition to being marked with about four inconspicuous spiral bands, are beset with numerous slender flexuose spines 5 to 10 μ long. It appears only to have been found near Iowa City, and exclusively on the bark of poplar in the month of October. Scattered spines are occasionally met with on the elaters of T. contorta, and T. Iowensis appears to be an extreme local form of this species; a type specimen is in the British Museum Herb. Var. γ has been found in Norway, September 1894, in considerable abundance, and at stations separated by many miles. The only characters in which it
differs from var. a. is the membranous sporangium-wall, which is entirely free from granular deposits, and under a low magnifying power is seen to be embossed by the impression of the spores. This character, however, indicates so considerable a divergence from the type, that if further gatherings established its constancy this form should be marked as a distinct species.

Hab. On bark and dead wood.—β. Batheaston, Somerset (B. M. 351); a. Lyme Regis, Dorset (L:B.M.139); a. Wanstead, Essex (L:B.M.139); β. Menmuir, Brechin, Scotland (B. M. 365); a. France (K. 997); a. Germany (K. 1771); a. Poland (Strassb. Herb.); β. Switzerland (Strassb. Herb.); β. Sweden (K. 1702); β. Norway (Christiania Herb.); β. Mass., U.S.A. (L:B.M.139); β. Iowa (L:B.M.139); a. Montana (L:B.M.139); γ. on fir and birch, Norway (L:B.M.139).

8. T. erecta Rex, in Proc. Acad. Nat. Sc. Phil. (1890), p. 193. Plasmodium? Total height 1 to 2 mm. Sporangia globose or subturbinate, stipitate or nearly sessile, scattered, 0·5 to 0·7 mm. diam., bright yellow, mottled with well-defined, dark brown angular patches; sporangium-wall membranous, pale yellow, densely charged with brown angular matter in the dark patches. Stalk cylindrical, 0·5 to 1 mm. high, 0·2 to 0·3 mm. thick, dark brown, opaque. Capillitium of cylindrical bright yellow elaters, 3·5 to 4 μ diam., with short tapering ends; marked with four bands forming a close irregular spiral, beset with numerous spines. Spores yellow, delicately warted, 11 to 13 μ diam.—Mass., Mon., p. 184.

Plate LXII., A.—e. sporangia, × 20; f. elater, × 600; g. spore, × 600 (United States).

A single specimen of this species has been found at Lyme Regis, agreeing in every respect with the type received from Dr. Rex, except that the stalk is very short, 0·5 mm. high.

Hab. On dead wood, etc.—Lyme Regis, Dorset (L:B.M.140 slide); Philadelphia (L:B.M.140).

9. T. fallax Pers., Obs. Myc., i., p. 59 (1796). Plasmodium rose-coloured or white, in rotten wood. Total height 1·5 to 3 mm. Sporangia turbinate, stipitate, gregarious, 0·6 to 0·8 mm. diam., shining olive or yellow-brown; sporangium-wall yellow, membranous, of two layers. Stalk cylindrical, furrowed, 0·5 to 1 mm. long, olive or dark brown; hollow, filled to the base with spores or spore-like cells. Capillitium of cylindrical, smooth, olive-brown elaters, 4·5 to 5·5 μ diam., marked with four or five spiral bands, 0·5 to 1 μ broad, with intervals of 0·5 to 3 μ, gradually tapering into long slender points. Spores yellow-brown, minutely warted, or more or less distinctly reticulated on one side, 9 to 12 μ diam.—Rost., Mon., p. 243; Cooke, Myx. Brit., p. 61, figs. 221, 222, 233, 235; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 12; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 128; Mass., Mon., p. 192. Arcyria decipiens Pers., in Usteri, Ann. Bot., xv., p. 35 (1795).

Plate LXII., A.—a. sporangia, × 20; b. elater, × 600; c. spores, × 600 (England); d. spore, reticulated on one side, spinulose on the other (United States).
The elaters vary in length in different gatherings; usually they are long and taper only towards the ends; sometimes they are short and somewhat fusiform, and either simple or branched. The warts on the spores may be scattered, numbering eight to ten in a line across the hemisphere, or more crowded; in some American specimens the spores are closely reticulated on one side, and spinulose on the other. The white and rose-coloured plasmodia have not been observed growing together on the same piece of wood, but the sporangia produced from both appear to be identical in every respect; although shades of difference occur in various gatherings, the colour of the plasmodium cannot be inferred from the ripe fruits.

**Hab.** On dead wood. Common.—St. Catherines, Somerset (B. M. 387, 359, etc.) ; Lyme Regis, Dorset (L. B. M. 141) ; Boynton, Yorkshire (B. M. 1124) ; France (K. 1059) ; Germany (B. M. 749, 750) ; Iowa (B. M. 836) ; S. Carolina (K. 1053).


a. genuina: stalks purple or purple-brown, 1 to 1·5 mm. long; elaters brown or ochraceous-brown, terminating in a slender tapering point, from 50 to 70 μ long; the spirals disappearing in the last third; spores yellow.

**Hab.** On wood.

b. lateritia: stalks red, 2 mm. or more long; elaters pale burnt-sienna colour, terminating in a more or less abruptly taper-
ing point, 20 to 40 \( \mu \) long, the spirals continued almost to the extremity; spores orange-yellow.—\textit{T. lateritia} Lév., \textit{f.c.}

\textit{Hab.} On wood.

\( \gamma \). \textit{flavicoma}: sporangia minute; stalks brown, 0.25 mm. long; elaters bright yellow, of the form \( a \); spores yellow.

\textit{Hab.} On dead leaves.

\( \delta \). \textit{subfusc\ae{}a}: stalks purple-brown, 0.5 mm. long; elaters bright yellow, of the form \( \beta \); spores bright yellow.—\textit{T. subfusc\ae{}a} Rex, \textit{f.c.}

\textit{Hab.} On wood.

Plate LXII., B.—\textit{a.} var. \textit{a. genuina}, sporangia, \( \times 20 \); \textit{b}, \textit{c.} elaters, \( \times 600 \); \textit{d.} spore, \( \times 600 \) (England); \textit{e.} var. \textit{b. lateritia}, sporangia, \( \times 20 \); \textit{f}, \textit{g}. \textit{h.} elaters, \( \times 600 \); \textit{i.} spore, \( \times 600 \) (Germany); \textit{j.} var. \( \gamma \). \textit{flavicoma}, sporangia, \( \times 20 \); \textit{k.} elater, \( \times 600 \) (England); \textit{l.} var. \( \varepsilon \). \textit{subfusc\ae{}a}, sporangium, \( \times 20 \); \textit{m.} elater, \( \times 600 \); \textit{n.} spore, \( \times 600 \) (United States).

The various characters distinguishing the different forms of this abundant species blend freely into one another, but the colour of the capillitium and spores is generally associated with a form of the elaters of sufficient constancy to enable the specimens to be classed under the above varieties. The three varieties given by Rostafinski are distinguished by the colour of the sporangia, and of the capillitium and spores when seen in mass; but the colour of the sporangium is a character which varies so widely that it cannot be taken as marking constant types; specimens in the Strassburg Herbarium have sessile, black, and brittle sporangia associated with others of brown and bright nut colour; a few have long stalks, and others are clustered on a common stem. In a large cultivation from a single growth of plasmadium at Lyme Regis, the sporangia are either olive or rosy-purple, marbled over with yellow lines of dehiscence, or almost uniformly black. \textit{T. lateritia} Lév., from Chili (K. 1761), here taken as the type of var. \( \beta \), has nearly black sporangia, but other gatherings from England and the Continent, with similar characters of capillitium and spores, have either black, rosy, or brown sporangia. The "simple" or "botrytis" forms are mingled in most large gatherings, but the "botrytis" form is most frequent in var. \( \beta \). The type specimen of \textit{T. Decaisneana} de Bary, in the Strassburg Herbarium, is included under var. \( \beta \); the elaters are remarkably long, suddenly narrowing to a point 10 to 15 \( \mu \) in length, from a subterminal bulb; a similar bulb occurs in the middle of some of the elaters; the occurrence of bulbous swellings in the elaters is so frequent and at the same time so inconstant in many species of \textit{Trichia} that it can scarcely be received as a specific character. \textit{T. Carlyleana} Mass. is the form \( a \) with minutely spinulose spores, perhaps more nearly smooth than may be considered typical. \textit{T. purpureascens} Nyl., of which a type specimen has been furnished by Prof. Blytt, is also form \( a \), and has dull purple sporangia; the spores average 10 \( \mu \) diam., and are minutely spinulose. The form \( \gamma \). \textit{flavicoma} has been obtained from Moffat, and on four separate occasions on leaves at Lyme Regis; the sporangia are brown, or purple with yellow lines of dehiscence, and the elaters bright yellow. \textit{T. subfusc\ae{}a} Rex, here placed as var. \( \delta \) of \textit{T. Botrytis}, has dull brown sporangia, and differs from var. \( \gamma \) only in the ends of the elaters being shorter and with more prominent spirals, a character of not sufficient importance to give the form specific rank.
Hab. On dead wood and leaves. Common.—Orton, Leicester (B. M. 391); Lyme Regis, Dorset (L:B.M.142); Leigh, Somerset (B. M. 399); Glamis, Scotland (B. M. 385); Germany (B. M. 759); Poland (Strassb. Herb.); Finland (K. 1090); Switzerland (B. M. 760); Italy (B. M. 758); Ceylon (B. M. 762); Australia (K. 1082); Tasmania (K. 1759); New Zealand (K. 1098); Philadelphia (L:B.M.142); Mass., U.S.A. (L:B.M.142); Chili (K. 1761).

Species excluded from the genus.

\[ T. \text{Kickxii Rost.} = \text{Oligonema nitens Rost.} \]
\[ T. \text{pusilla Schroet.} = \text{Oligonema nitens Rost.} \]
\[ T. \text{nana Mass.} = \text{Hemitrichia Wigandii Lister.} \]

Genus 34.—**Oligonema** Rostafinski, Mon., p. 291 (1875). Sporangia minute, densely clustered; capillitium scanty, of short or long threads, with spiral markings indistinct or wanting; spores reticulated.


Plate LXI. A.—d. sporangia, \( \times 20 \); e. elaters, \( \times 600 \); f. spore, \( \times 600 \) (Ardennes: Libert's type).

This species varies in the markings on the elaters and the reticulation of the spores; few gatherings are exactly similar, and great variety is often seen in a single sporangium; the length of the elaters in some specimens is only about 50 \( \mu \), while in others the average is from five to seven times as long. A gathering from South Carolina in Ravenel's collection (B. M. 960, 961) shows some sporangia with capillitium forming a network with few free ends as in Hemitrichia, while others have more or less branched and free elaters. **O. nitens** is allied to **Trichia affinis** and **T. persimilis**, in which species similar variations in spores and elaters are sometimes found in sporangia which have
been exposed to unusual conditions of development. *O. Bavariicum* Balf. & Berl. is described as distinguished from *O. nitens* by the more distinct spirals on the elaters, but the spirals are as distinct in Libert's type of the species; the spores of the Bavarian gathering vary in size from 12 to 16 μ, and the reticulation also varies so as to present from four to sixteen meshes on the surface of the hemisphere. The type specimens of *O. flavidum* Peck and *O. brevifilum* Peck differ from one another only in the former having more papillose and longer elaters than the latter, and spores measuring 12 to 14 μ, while in *O. brevifilum* they measure 10 to 12 μ; they scarcely differ from the specimen named *O. Bavariicum*, and are here included under *O. nitens*. The type specimens of *O. minutulum* Mass., from Algiers (B. 1739), and *Physarum Schweinitzii* Berk., from Bethlehem, U.S.A. (K. 1738), are typical *O. nitens*. The descriptions of *Trichia Kickxii* Rost. and *T. pusilla* Schroet. agree so perfectly with the character of *O. nitens* that they are here placed as synonyms of this species.

*Hab.* On dead wood.—Near Birmingham (L:B.M.144); Belgium (B. M. 747); Germany (Strassb. Herb.); Bavaria (B. M. 746); Algiers (K. 1739); Philadelphia (L:B.M.144); Ohio (L:B.M.144); Iowa (B. M. 1031); S. Carolina (B. M. 960, 961, 964).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**


*Hab.* On pine-wood.—Mustiala, Finland.

3. *O. furcatum* Bucknall, in Mass., Mon., p. 173. Sporangia scattered, globose, shining, bright chrome-yellow, as well as the capillitium and spores; elaters cylindrical, simple or branched, slightly thickened at the obtuse ends, with a faint open spiral, 3 to 4 μ diam.; spores globose, minutely warted, 11 to 12 μ diam.

*Hab.* On a rotting trunk.—Abbots Leigh, Somerset, England.

**SPECIES EXCLUDED FROM THE GENUS.**

*O. Broomei* Mass. = *Perichaena populina* Fr.

Genus 35.—**HEMITRICHIA** Rostafinski, Versuch, p. 14 (1873). Sporangia stalked or sessile; capillitium an elastic network of more or less branching threads, thickened with two to six spiral bands; spores minutely warted or reticulated. *HEMIARCYRIA* Rost., Mon., p. 261 (1875).

I have restored the original name which Rostafinski gave to this genus, being in accordance with the laws of botanical nomenclature, while at the same time it expresses more accurately the affinities of the group.
KEY TO THE SPECIES OF HEMITRICHIA.

A. Spores nearly smooth, or minutely warded:
   a. Capillitium red, spinose.  1. H. rubiformis
   b. Capillitium yellow or yellow-brown—
      a. Sporangia stalked—
         Stalk solid.  2. H. intorta
         Stalk hollow, filled with spore-like cells—
         Cup papillose.  3. H. clavata
         Cup smooth.  4. H. leiocarpa
   b. Sporangia sessile—
      Spirals of capillitium one to three, prominent, sporangium-wall membranous.  5. H. Wigandii
      Spirals of capillitium three or more, indistinct, sporangium-wall thickened with granular deposits.  6. H. Karstenii

B. Spores reticulated:—
   Capillitium threads spinose.  7. H. Serpula
   Capillitium threads smooth.  8. H. chrysospora

1. H. rubiformis Lister. Plasmodium purple-red, in rotten wood. Total height 1·3 to 2·5 mm. Sporangia clavate or sub-cylindrical, stipitate or sessile, combined in clusters or crowded, 1 to 1·3 mm. high, 0·5 to 0·7 mm. broad, glossy or shining, dark red, red-brown, or olive-black; sporangium-wall of two layers, the outer continued into the stalk, the inner enclosing the spores, orange-red. Stalks membranous, 0·2 to 1 mm. high, usually combined in clusters of from six to twelve, furrowed and rugose, red, not enclosing spore-like cells. Capillitium of twisting, sparingly branched, orange-red threads 5 to 6 μ diam., marked with three to five regular spiral bands, beset with numerous scattered spines 2 to 5 μ long, rarely nearly smooth, with few pointed free ends. Spores pale orange-red, warty, 10 to 11 μ diam.—Hemiarcyria rubiformis Rost., Mon., p. 262; Cooke, Myx. Brit., p. 67, figs. 201, 230, 231; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 13; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 133. Trichia rubiformis Pers., in Römer, N. Mag. Bot., i., p. 88 (1794). Arcyria rubiformis Mass., Mon., p. 158. Trichia Neesiana Corda, Ic., i., p. 23.
   a. genuina: sporangia red-brown.
   b. Neesiana Rost.: sporangia olive black.

Plate I.XIII., A—a. sporangia. × 20; b. capillitium and spores, × 280; c. capillitium and spore, × 600 (England).

Sporangia are occasionally found with a few free elaters pointed at each end, in addition to the continuous network of threads of the usual type.
Hab. On dead wood.—Orton, Leicester (B. M. 335, 338); Rudloe, Wilts (B. M. 340); Batheaston, Somerset (B. M. 341); Wanstead, Essex (L:BM.145); Hampstead, London (B. M. 1123); Boynton, Yorkshire (B. M. 1126); France (K. 123); Germany (B. M. 791, 700); Italy (B. M. 780); Finland (B. M. 788); Poland (Strassb. Herb.); Iowa (B. M. 830); Texas (B. M. 956); S. Carolina (B. M. 761).

2. **H. intorta** Lister. Plasmodium watery-white. Total height 1 to 1.5 mm. Sporangia turbinate, stipitate, gregarious or scattered, 0.3 to 0.7 mm. diam., shining, yellow or olive-yellow; sporangium-wall membranous above, thickened with granular deposits towards the base, papillose on the inner side. Stalk thickened above and below, with two to four broad longitudinal furrows, 0.5 to 0.7 mm. long, 0.15 mm. thick in the middle, glossy, purplish-brown, solid, not filled with spore-like cells. Capillitium a twisted tangle of sparingly branched orange-yellow threads, 4 μ diam., marked with four to five more or less distinct, closely set, spiral bands, sometimes connected with longitudinal striae, densely spinulose or nearly smooth. Spores yellow, minutely warty, 9 to 13 μ diam.


a. **genuina**: spirals on elaters distinct, usually spinulose; spores 9 to 10 μ.

β. **leiotricha**: spirals on elaters indistinct, smooth; spores 12 to 13 μ.

Plate LXIII., B.—a. **genuina**, sporangia, × 20; b. capillitium and spores, × 600 (England); c. **leiotricha**, sporangium, × 20; d. capillitium and spores, × 600 (England).

The var. **genuina** appeared in considerable abundance near Hitchin in March 1889 and January 1890. It was also gathered near Birmingham by Mr. Camm in October 1889, and was described in the Journal of Botany, September 1891. A few months later it was independently recorded in Proceedings of the Academy of Natural Science of Philadelphia by Dr. Rex under the name of **H. longijila**. Specimens received from Dr. Rex, and Prof. Macbride, of Iowa University, are essentially identical with the English gatherings.

The var. **leiotricha** is a form which has been met with on five occasions—three times in a larch plantation near Lyme Regis, once in a fir wood at Leighton Buzzard, and on dead leaves at Sande, Norway. In external appearance it resembles var. **genuina**; the capillitium is profuse and of a bright yellow colour. In the Lyme Regis gatherings the threads are almost smooth, with a faint indication of spiral markings; free ends are more numerous in some sporangia than in others. In the Leighton gathering the threads in some cases are nearly smooth, and more or less in the form of long branching elaters of the type of **Trichia**; in others they have the true **Hemitrichia** character, with few free ends. They are marked with distinct spirals (represented Pl. LXIII., B, fig. d). This form would come under the description of **H. intorta**, except in the size of the spores, which measure 12 to 13 μ. Until further material can be met with, it is placed as a variety of **H. intorta**, with which it is very closely allied. It is interesting as affording another instance of the **Trichia** and **Hemitrichia** characters being exhibited in one species, as
has also been found in *H. chrysospora*, and occasionally in *H. rubiformis*.

_Hab._ On dead wood.—Hitchin, Herts (L:B.M.146); Norway (L:B.M.146); Iowa (L:B.M.146).


Plate LXIV., A.—a. sporangia, × 20; b. capillitium, × 600; c. spores, × 600 (England); d. sporangia developed in cold weather, × 20; e. capillitium of same, beset with spines appearing in limited tracts among threads of the usual form, b, × 600 (United States); f. a portion of the papillose sporangium-wall, × 600; g. sporangium with expanded capillitium, × 20 (United States).

The type specimen of *Arcyria stipitata* Mass., from Java (K. 1768), is an unusually long stalked but typical form of *H. clavata*, apparently without free ends to the capillitium. The type of *Arcyria decipiens* Berk., collected by Charles Darwin at Rio Janeiro (K. 1766), is typical *H. clavata*.

_Hab._ On dead wood.—Batheaston, Somerset (B. M. 354); Dudley, Stafford (L:B.M.147); Lyme Regis, Dorset (L:B.M.147); France (K. 134); Germany (B. M. 792, 794); Poland (Strassb. Herb.); Natal (K. 148); Ceylon (K. 1765); Java (K. 1768); Borneo (L:B.M.147); Bonin Islands (K. 138); Philadelphia (L:B.M.147); Iowa (B. M. 831, 1024, 1031); S Carolina (B. M. 796); Cuba (K. 1765a); Venezuela (K. 1767); Rio Janeiro (K. 1766); French Guiana (Paris Herb.); Paraguay (Paris Herb.); Chili (Paris Herb.).

4. **H. leiocarpa** Lister. Plasmodium? Total height 1·5 mm. Sporangia obovoid, rarely subglobose, pale grey or ochraceous-grey, 0·7 mm. diam.; sporangium-wall evanescent above; the cup membranous, smooth, colourless, longitudinally plicate, minutely and transversely wrinkled. Stalk 0·7 mm. long, 0·05 mm. thick, furrowed, ochraceous-grey, containing spore-like cells. Capillitium
a network of frequently branching pale grey threads, 2 to 5 \( \mu \) thick, marked with three to five often prominent spiral bands, sometimes smooth, but in many parts beset with numerous spines about 2 \( \mu \) long; free ends subclavate, usually spinulose. Spores smooth, pale grey in mass, 6 to 8 \( \mu \) diam.—


Plate LXIV., B.—a. sporangia, \( \times 20 \); b. portion of cup of sporangium-wall, \( \times 600 \); c. capillitium, \( \times 600 \); d. spore, \( \times 600 \) (Maine, U.S.A.: part of type).

This species is closely allied to _H. clavata_, differing in the pale colour, in the smooth colourless sporangium-wall, the smooth spores, and in the spinose tracts of the capillitium, which in _H. clavata_ is an exceptional character. _H. Varneyi_ Rex has a more elongated sporangium and a shorter stalk; but, in comparing the specimen kindly furnished by Dr. Rex with the type of _H. leioecarpa_, the other characters appear to be identical.

_Hab._ On dead wood.—Maine, U.S.A. (L:B.M.147\( \alpha \)); Kansas (L:B.M.147\( \alpha \) slide).

5. _H. Wigandii_ Lister. Plasmodium rose-red. Sporangia subglobose or turbinate, sessile, rarely shortly stalked, crowded or gregarious, 0·4 to 0·7 mm., opaque or shining, yellow, yellow-brown, or ochraceous; sporangium-wall membranous, yellow, smooth. Capillitium a tangle of sparingly branched, ochraceous-yellow threads, 3 to 5 \( \mu \) diam., marked with one to three prominent bands, forming an irregular loose spiral, with few rounded or bulbous free ends. Spores yellow, minutely warted, 9 to 12 \( \mu \) diam.—_Hemiareyria Wigandii_ Rost., Mon., p. 267 (1875); Cooke, Myx. Brit., fig. 232. _Aceryria Wigandii_ Mass., Mon., p. 163. _Trichia nana_ Mass., in Journ. R. Micr. Soc. (1889), p. 336; Mass., Mon., p. 181.

Plate LXIV., B.—c. sporangia, \( \times 20 \); f. capillitium, \( \times 600 \); g. spore, \( \times 600 \) (Germany: Rostafinski’s type); h. sporangia, \( \times 20 \) (United States).

The type specimen of _Trichia nana_ Mass., from Westbrook, Maine (K. 116\( \alpha \)), is _H. Wigandii_, agreeing perfectly with Rostafinski’s type from Freiburg in the loose capillitium, with one or two lax and irregular spiral bands; the sporangia measure 0·3 to 0·5 mm. diam. In extensive gatherings made in Norway, on fir wood, some sporangia have short slender stalks filled with spore-like cells.

_Hab._ On dead wood.—Germany (Strassb. Herb.); Norway (L:B.M. 148); Mass., U.S.A. (L:B.M.148); Maine (K. 116\( \alpha \)).

6. _H. Karstenii_ Lister. Plasmodium? Sporangia forming elongated, curved plasmodiocarps, 0·3 to 0·5 mm. broad, or subglobose, sessile; pale brown, red, or purplish-brown; mass of capillitium and spores yellow or orange-red; sporangium-wall thickened with deposits of granular matter. Capillitium a tangle of branching yellowish or reddish-brown threads, 3 to 5 \( \mu \) diam.,

Plate LXV., A.—a. plasmodiocarp, × 20; b. portion of sporangium-wall, showing the granular outer and membranous inner layers, × 280; c. capillitium and spores, × 280; d. capillitium, × 600; e. spore, × 600 (England).

This species appears to be a Hemitrichia form of Trichia contorta, which it resembles in every respect, except that the capillitium threads are combined instead of forming free elaters; the same variety in shape and colour of the sporangia, and in the markings and colour of the capillitium, occur as in that species. Rostafinski’s type specimen from Ceylon (K. 1773) has pale yellow-brown sporangia and rugged capillitium, with faint spirals and many large rounded expansions; the spores are yellow, minutely warted, and measure 10 to 11 μ diam. Specimens from near Dudley, found by Mr. Camm, have both globose and plasmodiocarp purple-brown sporangia and orange-brown capillitium, strongly contrasting with the yellow spores. The type specimen of Areyria paradoxa Mass., from Weybridge (K. 132), closely resembles the Ceylon gathering of H. Karstenii, only differing in the more regular, less branched capillitium, with fewer expansions; it must therefore be included under that species. The mounting of Hemiarcyria obscura Rex, l.c. (L:B.M.149), furnished by Dr. Rex, shows a dull yellowish-red capillitium; the threads are 2·5 to 3 μ thick, and are marked with close faint spirals; they have nearly the same colour as those of the Dudley specimen, but are more uniform, with inconspicuous swellings; the spores are similar to those of the type of H. Karstenii at Kew, and there appears to be no specific character to separate it from that species.

Hab. On dead leaves.—Dudley, Stafford (L:B.M.149); Weybridge, Surrey (K. 132); Ceylon (K. 1773); Montana, U.S.A. (L:B.M.149 slide).

7. H. Serpula Rost., Versuch, p. 14 (1873). Plasmodium? Sporangia forming elongated, winding, branched plasmodiocarps, 0·4 to 0·6 mm. wide, usually combined to form a close net, golden-yellow; sporangium-wall of two layers, yellow. Capillitium a tangle of twisting, sparingly branched, yellow threads, 5 to 6 μ diam., marked with three to four well-defined regular spiral bands 0·7 μ wide, with intervals of 1 to 2 μ, strongly spinose; longitudinal striae often distinct; free ends pointed. Spores yellow, reticulated with narrow bands, forming a net with about nine meshes to the hemisphere, 10 to 12 μ diam.; border 0·5 to 1 μ wide.—Hemiarcyria Serpula Rost., Mon., p. 266 (1875); Cooke, Myx. Brit., p. 68, figs. 200, 227, 228; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 135. Mucor Serpula Scop., Fl. Carn., Ed. 2, ii., p. 493 (1772). Trichia Serpula Pers., in Römer, N. Mag. Bot., i., p. 90 (1794). Areyria Serpula Mass., Mon., p. 164.
8. **H. chrysospora** Lister. Plasmodium? Sporangia sub-globose, sessile, crowded or scattered, 0·5 to 1 mm. diam., glossy, bright yellow; sporangium-wall membranous, with minute thickenings in the form of a broken irregular reticulation. Capillitium a network of branching, yellow threads, 5 µ diam., with four to five narrow bands arranged in a close, regular spiral, and connected by longitudinal striae; the threads provided with many shortly pointed free ends, and attached to various parts of the sporangium-wall. Spores yellow, reticulated with narrow, sharply defined bands, forming a regular net with six to nine meshes to the hemisphere, 16 to 18 µ diam.; border 1·5 to 2 µ broad.—**Hemiarcryia chrysospora** Lister, in Grev., xv., p. 126 (1887); Mass., in Journ. R. Micr. Soc. (1889), p. 357. **Arcryia chrysospora** Mass., Mon., p. 164.

Plate LXV., B.—a. sporangia, × 20; b. capillitium, × 600; c. spore × 600 (England).

This species was first found on fallen twigs and moss in a larch plantation near Lyme Regis, November 1886. A small gathering was obtained in another larch plantation near the same place in November 1890, agreeing in all respects with the above, except that the capillitium consisted of long free elaters.

*Hab.* On dead twigs.—Lyme Regis, Dorset (L:B.M.151).

**Species referred to Hemiarcryia, not met with in the quoted collections.**

9. **H. calyculata** Speg., in Annal. Soc. Cient. Argent., x., p. 152 (1880). Sporangia simple, gregarious, stipitate, globose or ellipsoid, 1 to 2 mm. diam., dull fulvous-brown. Stalk 2 to 5 mm. long, 0·2 to 0·25 mm. thick, terete, glabrous, firm, expanded above into a cup which is half the height of the sporangium, the base expanded, fibrillose, concolorous. Capillitium and spores dull yellow; elaters 7 to 8 µ thick, branches few, with pointed free ends, cylindrical; spiral bands three to five, even, somewhat inconspicuous, with interspaces of equal width, spinulose. Spores discoid-lenticular, margin muricate, 10 × 3 µ.

*Hab.* On dead willow.—Argentine Republic.

This description suggests a form of *Hemitrichia clavata*.

10. **H. melanopeziza** Speg., l.c., xii., p. 257 (1881). Sporangia sessile, creeping, subterete, usually forming rings, 1 to 2 mm.
long, black, scarcely or not at all shining, smooth; wall black, opaque, subcellular, subcoriaceous, splitting longitudinally and dehiscing in a valvate manner. Capillitium yellow or citron-yellow, protruded elastically; threads terete, 4 to 5 μ diam., combined into a loose net, everywhere covered with erect spines 5 to 6 x 1 μ, spirals obsolete. Spores elliptic-globose, papillososcabrid, 10 to 12 μ, yellow.

Hab. On bark.—Brazil.

This description applies well to Perichæna chrysosperma List.

11. H. pusilla Spec., l.c., xii., p. 257 (1881). Sporangia rather closely gregarious, subcylindrico-elliptical, 0.4 to 0.5 mm. high, 0.15 to 0.25 mm. diam., obtuse above, truncate below, stem almost or entirely wanting; at first amber-red, then rose-colour. Capillitium forming a rather dense network of terete rose-coloured threads, 3 to 4 μ thick; spirals three or four, furnished with minute spinules. Spores rose or flesh-coloured, globose, smooth, 7 to 9 μ diam.

Hab. On bark.—Argentina Republic.

SPECIES EXCLUDED FROM THE GENUS.

Hemiarcycia stipata Rost. = Arcyria stipata List.

Genus 36.—CORNUVIA Rostafinski, Versuch, p. 15 (1873). Sporangia sessile; capillitium a network of threads with thickenings in the form of simple rings; spores reticulated.

1. C. Serpula Rost., Versuch, p. 15 (1873). Plasmodium? Sporangia forming curved or branched plasmodiocarps, about 0.3 mm. broad, or subglobose, sessile, golden-yellow; sporangium-wall membranous, pale yellow. Capillitium a network of freely branching yellow threads, 3 to 5 μ diam., marked with well-defined, prominent ring-shaped thickenings, arranged at intervals of about 2 μ or irregularly scattered; junctions of the branches without thickenings. Spores yellow, reticulated with narrow bands forming a net with from eight to twelve meshes to the hemisphere, 10 to 12 μ diam.; border 0.5 to 1 μ broad.—Rost., in Fueckel, Symb. Myc., Nachtr. 2, p. 76 (1893); Rost., Mon., p. 239; Cooke, Myx. Brit., fig. 189. Arcyria Serpula Wigand, in Pringsh., Jahrb., iii., p. 44 (1863). Ophiotheca Serpula Mass., Mon., p. 135.

Plate LXVI., A.—d. plasmodiocarp, × 20; e. capillitium, × 600; f. spore, × 600 (Germany).

Hab. On tan.—Germany (B. M. 784 and Strassb. Herb.).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

2. C. dictyocarpa Krupa, in Cosmos, p. 377 (1886). Related to C. circumscissa Rost. (Perichæna chrysosperma Lister), but
differs in the inner sporangium-wall being furnished with depressed thickened lines, and breaking up, when mature, into quadrangular or pentagonal fragments.

_Hab._ On dried roots of _Robinia._—Poland.

This species is referred to in _Hedwigia_, 1887, p. 110, by Raciborski, as being indistinguishable in the description from _C. circumscissa_; the structure of the sporangium-wall suggests rather _Perichæna populinæ_ or _P. depressa._


_Hab._ On bark and wood of pine.—Finland.

The numerous free ends and ring-shaped thickenings of the elaters and the smooth spores suggest that this is an irregular form of _Trichia scabra._

4. _C. leocarpoides_ Speg., in Ann. Soc. Cient. Argent., xii., p. 256 (1881). Sporangia subglobose or pyriform, 0·6 to 0·8 mm. diam., yellowish-red or fulvous, not or scarcely shining; smooth; the wall rather thick, subcartilaginous, soon evanescent above, often forming a persistent cup below. Stalk rigid, erect, brown or blackish, slender, smooth or subrugulose, hardly exceeding the diameter of the sporangium. Capillitium elastically protruding, adnate at the base, long persistent, tobacco-coloured or fulvous-olive; threads slender, 5 to 6 μ thick, forming a dense net with many terete, rounded-truncate free ends; spiral bands three or four, smooth, not papillose. Spores globose, smooth, filled with granules, fulvous-olivaceous, 8 to 10 μ diam.

_Hab._ On rotten wood.—Apiahy, Brazil.

This description applies well to a form of _Hemitrichia clavata_ with many free ends to the capillitium.

Species excluded from the genus.

_C. circumscissa_ Rost. = _Perichæna chrysosperma_ List.
_C. depressa_ List. = _Dianema depressa_ List.
_C. metallica_ Rost. = _Margarita metallica_ List.
_C. Wrightii_ Rost. = _Perichæna chrysosperma_ List.

Order II.—_Arcyriaceæ_. Sporangia simple, stalked or sessile; capillitium combined into an elastic network, with thickenings in the form of half-rings, cogs, spines, or warts.
KEY TO THE GENERA OF *ARCYRIACEÆ*.

Sporangia stalked; sporangium-wall evanescent above, persistent and membranous in the lower third.  

(37) *Arcyria.*

Fig. 45.—*Arcyria punicea* Pers.  
*a.* Group of sporangia. Twice natural size.  
*b.* Capillitium. Magnified 250 times.  
*c.* Spore. Magnified 560 times.

Sporangia sessile, clustered; sporangium-wall single, persistent, papillose, not thickened with angular granules.  

(38) *Lachnobolus.*

Fig. 46.—*Lachnobolus circinans* Fries.  
*a.* Cluster of sporangia. Twice natural size.  
*b.* Capillitium and spore. Magnified 300 times.

Sporangia sessile or plasmodiocarps; sporangium-wall double, at least at the base; the outer layer thickened with dark angular granules.  

(39) *Perichæna.*

Fig. 47.—*Perichæna populina* Fries.  
*a.* Group of sporangia. Magnified 7 times.  
*b.* Capillitium and spore. Magnified 280 times.

Sporangia stalked; sporangium-wall evanescent above, persistent as a membranous cup in the lower third; stalk filled with spores or spore-like cells; capillitium with thickenings in the form of half-rings, cogs, spines, or broken reticulation, rarely with faint spirals in addition.
KEY TO THE SPECIES OF ARCYRIA.

A. Spores 9 to 11 \( \mu \) diam., sporangia orange-red or buff:
- Sporangia ovoid, wall reticulated. 1. *A. ferruginea*
- Sporangia clavate, wall papillose. 2. *A. versicolor*

B. Spores 6 to 8 \( \mu \) diam.:
- B. Capillitium attached to the cup—
  - Capillitium closely spinulose, grey, or yellowish-grey. 3. *A. albida*
  - Capillitium marked with cogs and half-rings; sporangia red, ovoid, or subcylindrical. 4. *A. punicea*
  - Capillitium marked with transverse bands and minute spines; sporangia flesh-coloured, turbinate, small. 5. *A. insignis*

- B. Capillitium free from the cup—
  - a. Network of capillitium expanding, not drooping—
    - Capillitium marked with cogs and spines. 6. *A. incarnata*
    - Capillitium marked with cogs, spines, and three to four indistinct spiral bands in addition. 7. *A. stipata*
  - b. Network of capillitium much elongated, drooping—
    - Sporangia buff; wall evanescent above. 8. *A. flava*
    - Sporangia red; wall persistent above in shield-like fragments. 9. *A. Ærstedtii*

1. *A. ferruginea* Sauter, in Flora, xxiv., p. 316 (1841). Plasmodium rose-red, in rotten wood. Total height 1 to 2 mm. Sporangia ovoid, stipitate, crowded, 0·7 to 1·3 mm. high, 0·5 to 1 mm. broad, orange-red, or more rarely pale ochraceous; cup of sporangium even, shining, funnel-shaped, or at length nearly flat, marked with round-meshed reticulations on the inner side. Stalk cylindrical, 0·3 to 0·8 mm. long, 0·05 to 0·15 mm. thick, red, rarely white, arising from a well-developed membranous hypothallus; filled with spore-like cells. Capillitium an elastic network of freely branching yellow-brown threads, 5 to 8 \( \mu \) diam., diminishing to 2 to 3 \( \mu \) diam. towards the base, triangular or oval in section, thickened on one side with transverse bars or reticulations, on the other two sides marked with a broken reticulation or with warts, often spinulose throughout; a few sparingly branched slender threads penetrate the tube of the stalk without attachments to the cup; free ends with rounded or pointed tips are not unfrequent, but often wanting. Spores pale red or ochraceous, faintly and closely warded, 8 to 11 \( \mu \) diam.—Rost., Mon., p. 279; Cooke, Myx. Brit., p. 73, fig. 194; Blytt, Bidr.

Plate LXVI., B.—a. sporangia, × 20; b. portion of sporangium-wall, × 600; c, d. threads of upper part of capillitium, × 600; e. thread of basal part of capillitium, × 600 (England); f. capillitium of type of *A. dictyonema* Rost. × 600 (Germany); g. capillitium of type of *Heterotrichia Gabriellae* Mass. × 600 (United States).

This species varies considerably in the markings on the capillitium; the network of a single sporangium may in some parts be conspicuously thickened on one side; in other parts the threads may appear nearly uniformly spinulose. In the type specimen of *A. dictyonema* Rost., from Freiburg, in Strassburg Herbarium, the capillitium is spinose, principally on one side of the thread, with broken reticulation and spinules on the other part; there are numerous free branches with clavate or pointed ends; except that the spines are more developed than usual, the markings do not differ from those frequently seen in typical *A. ferruginea*, of which it must be considered a form. The type specimen of *Heterotrichia Gabriellae* Mass., from S. Carolina (K. 836), differs from *A. ferruginea* only in the numerous pointed free ends in the upper part of the net of the capillitium; the threads are flattened, very closely reticulate and spinulose, and in many places thickened on one side; the spores measure 10 to 11 μ. The abundance or scarcity of free ends varies much in different gatherings of *A. ferruginea*, and is not a sufficient character on which to base a species. *A. macrosora* Peck appears from the description to differ in no respect from typical *A. ferruginea*.

_Hab._ On dead wood.—Leytonstone, Essex (L:B.M.153); Lyme Regis, Dorset (L:B.M.153); Leighton, Beds (L:B.M.153); Henlys, Anglesey (B. M. 1130); France (K. 921); Germany (B. M. 727); Norway (Christiania Herb.); Australia (K. 848); Mass., U.S.A. (L:B.M.153); S. Carolina (B. M. 966).

2. *A. versicolor* Phillips, in Grev., v., p. 115 (1877). Plasmodium? Total height 2-5 to 3 mm. Sporangia pyriform or clavate, shortly stipitate or sessile, gregarious, 1 to 2 mm. diam., more or less shining, yellow or olivaceous-yellow; sporangium-wall membranous, persistent except at the apex, yellow, papillose on the inner side. Stalk membranous, 0-2 mm. long, yellow-brown, filled with spore-like cells, arising from a well-developed hypothallus. Capillitium an elastic network of freely branching yellow threads, 4 to 6 μ diam., triangular or oval in section, either uniformly spinulose and marked with broken reticulation, or one side thickened and marked with transverse bars; the threads arise from the tube of the stem, and are not attached to the sporangium-wall; free ends shortly pointed. Spores yellow, smooth, 8 to 10 μ diam.—Mass., Mon., p. 149. *Arcyria vitellina* Phill., l.c., p. 115.

Plate LXVII., A.—a. sporangia. × 20; b. portion of sporangium-wall, × 600; c. capillitium and spore, × 600 (California).
This species is represented by two gatherings from California by Dr. Harkness (K. 839, 897); in one the sporangia and capillitium are bright yellow, in the other dull yellow; they received respectively the names *A. vitellina* Phill. and *A. versicolor* Phill., but as they agree in other respects they are united under the latter name. *A. versicolor* is closely allied to *A. ferruginea*, from the pale form of which it only differs in shape, in the papillose thickennings of the sporangium-wall, and the smoother spores.

*Hab.* On dead wood.—California (L:B.M.154).


a. **genuina** : sporangia ovoid, grey.

β. **pomiformis** : sporangia globose, yellow.—*A. pomiformis* Rost.

g. **globosa** : sporangia globose, white or pale ochraceous.—*Lachnobolus globosus* Rost.

Plate LXVII, B.—a, b, sporangia, × 20; c, globose sporangium on bramble, × 20; d, d' outer capillitium of a, often with half-rings and coarse spines on one side, d × 280, d' × 600; e, e' outer capillitium of the more usual form, with minute spines equally distributed; and smooth thread attached to sporangium-wall, e × 280, e' × 600; f, spore, × 600 (England); g, sporangium of *Lachnobolus globosus* Rost., on chestnut bur, × 20; h, capillitium of same, × 600 (United States); i, sporangium of *Lachnobolus globosus* var. minor Ellis, on male flower of chestnut, × 20 (United States).
This species is very variable in the shape of the sporangia. An extensive growth of the common grey form, arising from one development of plasmodium, will often exhibit much diversity; subglobose sporangia with short stalks and subcyllindrical sporangia with long stalks are found in company with the more usual ovoid form, either single, or combined in clusters of two to five, and then correspond with A. digitata Rost. Groups are also met with on dead Bramble stems in which the nearly white sporangia are shortly stalked and perfectly globose, 0·5 to 0·7 mm. diam.; but these are associated with other groups, showing all degrees of difference from subglobose to ovoid. Specimens from North and South America and from the tropics are usually elongated or cylindrical. The marking on the capillitium is also a variable character. In some gatherings of the grey form the threads are nearly uniform throughout, and either almost smooth, or spinulose, with the spines minute and equally distributed, or 1 to 2 μ long, either sharp-pointed or thickened at the apices; in other gatherings the threads are broad and papillose, as in Lachnobolus circinans. A. pomiformis Roth. has yellow globose sporangia and slender stalks, but the capillitium in the type specimens in Strassburg Herbarium does not differ, except in colour, from that frequently met with in the grey form. A. globose Schwein. (Lachnobolus globosus Rost.) appears to be a variety of A. albida occurring on the burs and catkins of chestnut in the United States: the globose sporangia measure 0·3 to 0·5 mm. diam., and are nearly white or pale ochraceous; the stalks are slender, one to one and a half times the length of the sporangium; the capillitium and spores resemble those of A. albida in all respects. Specimens received from Dr. Rex represent two varieties: one is confined to the burs of chestnut; the other, named var. minor by Ellis, is smaller, with longer stalks, and grows exclusively on the catkins. These forms on chestnut seem to be constant in shape; in English gatherings, however, the form growing on Bramble stems has usually a marked character, differing from those found on stumps in the more globose and smaller sporangia with short stalks, and though these characters are less constant than those of the American gatherings, it would appear that the latter may owe their shape to the special substances on which they grow, and are not specifically distinct from A. albida. The type specimen of A. Friesii Berk. & Br. (K. 896) is the grey ovoid form of A. albida, with typical capillitium and spores. A. digitata Rost. is the cylindrical form of A. albida, with sporangia mostly in clusters of three to seven together; the stalks usually equal the sporangia in length, and, though adhering, are easily separable; the "botrylė" arrangement cannot be viewed as having any specific value. The type of A. Cookei Mass., from Brazil (Trail—K. 865), is a tall grey form of A. albida; the sporangia measure 2 mm. in length, 0·5 mm. in breadth; the stalks are 2 mm. long, 0·1 mm. thick; the capillitium and spores are quite typical.

**Hab.** On dead wood, etc.—a. Batheaston, Somerset (B. M. 276, 281); b. Batheaston (B. M. 278); a. Lyme Regis, Dorset (I:635); a. Sibbertoft, Norths. (K. 896); a. France (K. 859); a. Germany (B. M. 713); a. and b. Poland (Strasbourg Herb.) a. Cape (K. 858); a. Japan (K. 866); a. Borneo (I:635); a. Australia (B. M. 714); Tonga Tabu (I:635); b. New Jersey (K. 877); a. Iowa (B. M. 828); y. Philadelphia (I:635); y. Ohio (K. 882); a. S. Carolina (B. M. 972, 976); a. Cuba (B. M. 716); a. Nicaragua (B. M. 1030); a. Venezuela (B. M. 715); a. French Guiana (Paris Herb.); a. Brazil (K. 865).
4. **A. punicea** Pers., in Römer, N. Mag. Bot., i., p. 90 (1794). Plasmodium white, in rotten wood. Total height 2 to 3 mm. Sporangia ovoid or subcylindrical, stipitate, crowded or gregarious, 0·9 to 1·8 mm. high, 0·8 to 1 mm. broad, crimson; cup of sporangium-wall membranous, firm, shining, plaited, smooth or marked with faint broken reticulations on the inner side. Stalk cylindrical, 0·5 to 1 mm. high, 0·1 mm. thick, furrowed, red-brown, filled with spore-like cells. Capillitium a regular elastic network of flattened or terete red threads, 3 to 5 μ diam., with thickening in the form of prominent cogs or spines, and half-rings or rings arranged in a loose spiral; with many attachments to the cup, and usually without free ends. Spores pale red, nearly smooth, but with a few scattered warts, 6 to 8 μ diam.—Rost., Mon., p. 268; Cooke, Myx. Brit., p. 69, fig. 197; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 11; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 123; Mass., Mon., p. 142. *Arcyria vernicosa* Rost., Mon., App., p. 36.

Plate LXVIII., A.—a. sporangia, × 20; b. capillitium and spore, with portion of sporangium-wall, × 600 (England).

The specimen named *A. fusca* Fr., in Fuckel, Fung. Rhen. 1443 (B. M. 708), appears to be a weathered but typical form of *A. punicea*; if this gathering is identical with Fries’s type, it confirms the opinion of Rostafinski, who gives the name as a synonym for *A. punicea*.

*Hab.* On dead wood. Common.—Batheaston, Somerset (B. M. 254, 269); Epping Forest, Essex (L:B.M.156); Lyme Regis, Dorset (L:B.M.156); Abbey Wood, Kent (B. M. 1153); Highgate (B. M. 1149) and Hampstead (B. M. 1150); Glaisdale, Yorkshire (B. M. 1146); France (B. M. 707); Germany (B. M. 708); Poland (Strassb. Herb.); Italy (B. M. 705); Cape (K. 898); Java (K. 1715); Borneo (L:B.M.156); New Zealand (K. 931); New York, U.S.A. (K. 908); Iowa (B. M. 1029); S. Carolina (B. M. 982); S. Domingo (Paris Herb.); Cuba (K. 950); New Granada (K. 1724); French Guiana (Paris Herb.); Brazil (K. 899).

5. **A. insignis** Kalchbr. & Cooke, in Grev., x., p. 143 (1882). Plasmodium? Total height 0·5 mm. Sporangia ovoid, stipitate, gregarious, 0·3 mm. diam., red; cup of sporangium-wall delicately membranous, plaited, spinulose. Stalk thickened upwards, furrowed, 0·2 mm. long, red, filled with spores or spore-like cells. Capillitium a delicate elastic network of almost colourless threads, varying in width from 2 to 5 μ, flattened, with thickenings in the form of faint transverse bands and short spines arranged in a lax spiral, closely and minutely spinulose elsewhere. Spores almost colourless, nearly smooth, 6 to 8 μ diam.—Mass., Mon., p. 148.

Plate LXVIII., A.—c. sporangia, × 20; d. capillitium and spores, with portion of sporangium-wall, × 600 (Cape).

There are two specimens of this form in the Kew Herb., one, the type, from the Cape (Kalchbrenner—K. 895), and one marked “*A. punicea*, Natal” (K. 949). They resemble a minute form of *A. incarnata*, but the delicate capillitium attached to the cup of the sporangium-wall appears to mark it as distinct.
Hab. On dead wood.—Cape of Good Hope (K. 895, 949; L:B.M.157 slide).

6. A. incarnata Pers., Obs. Myc., i., p. 58 (1796). Plasmodium white, in rotten wood. Sporangia subcylindrical or ellipsoid, stipitate, or nearly sessile, crowded, 1 to 1·5 mm. high, 0·6 mm. broad, flesh-coloured, more rarely red; cup of sporangium-wall membranous, even or interruptedly plicate, spinulose. Stalk weak, 0·1 to 0·3 mm. long, flesh-coloured, filled with spore-like cells. Capillitium a very loose elastic network of pale pink threads, 3 to 5 μ diam., sparingly and somewhat irregularly branched, with here and there broad perforated or ring-like expansions, often swollen at the axes of the branches; thickenings in the form of sharp cogs, half rings, or spines arranged as a border or in a loose spiral, and of minute scattered spinules; free ends present, more or less numerous, clavate or pointed, spinose. Spores pale flesh-coloured, smooth or with a few scattered warts, 6 to 8 μ diam.—Rost., Mon., p. 275; Cooke, Myx. Brit., p. 71, figs. 187, 199; Mass., Mon., p. 145. Stemonitis incarnata Pers., in Gmel., Syst. Nat., p. 1467 (1791). Clathrus adnatus Batsch, Elench. Fung., p. 141 (1783). Arcyria adnata Rost., Mon., App., p. 36; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 11; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 124.

Plate LXVIII., B.—a. sporangia, × 20; b. capillitium, with portion of sporangium-wall, and spores, × 280; c. spore, × 600 (England).

This species is closely allied to A. punicea, from which it is chiefly distinguished by the capillitium having free ends and being without attachments to the cup, and by the more diffusely expanding net; but intermediate forms are of not infrequent occurrence.

Hab. On dead bark, sticks, etc.—Lyne Regis, Dorset (L:B.M.158); Luton, Beds (L:B.M.158); Batheaston, Somerset (B. M. 270); Edinburgh (K. 886); France (Paris Herb.); Germany (B. M. 719); Finland (B. M. 704A); Poland (Strassb. Herb.); Australia (K. 892); Philadelphia (L:B.M.158); S. Carolina (K. 843).

7. A. stipata Lister. Plasmodium? Total height 1·5 to 2 mm. Sporangia cylindrical, stipitate, crowded, 1 to 1·5 mm. high, 0·6 mm. broad, copper-coloured, or deep brown with a carmine tinge; sporangium-wall irregularly evanescent above, the cup plaited and smooth below, papillose at the rim. Stalk cylindrical, 0·5 to 1 mm. long, red-brown or brownish-black, filled with spore-like cells, and rising from a membranous hypothallus. Capillitium an elastic network of freely branching red threads, 2·5 to 3·5 μ diam., marked with a border of broad-based spines or blunt cogs, and with three to four faint spiral bands, sometimes covered with minute spines in addition; with many free clavate ends and few attachments to the cup. Spores pale red, smooth, or with few scattered warts, 6 to 8 μ diam.—Leanigium stipatum Schwein., in Trans. Am. Phil. Soc., New Ser. 4, p. 258 (1834). Hemiarcyria stipata Rost., Mon., App., p. 41; Macbride, in Bull. Nat. Hist. Iowa, p. 135.
Plate LXX., A.—a. sporangium with expanded capillitium, × 20; b. capillitium of upper part, × 600; c. capillitium of lower part, × 600; d. spore, × 600 (Ceylon); e. sporangia, × 20; f. capillitium of upper part, × 600; g. capillitium of lower part, × 600 (Iowa).

This species has been principally recorded from the United States, and is well described by Prof. Macbride; the faint spiral bands on the threads are either distinct or absent in different parts of the same capillitium, and their presence is not a sufficient character to remove the species from the genus Arcyria, with which it agrees in all other respects. Two gatherings of A. stipata have been obtained from India; one from Nepal (K. 951), and one from Ceylon (B. M. 709). Both are marked A. purple; the first is orange-red, the other bright scarlet; in both the capillitium forms a net of freely branching sinuous threads, with a border of closely-set blunt cogs; in some parts the thickenings consist of scattered spines, and towards the cup many of the threads are nearly smooth; throughout the network the characteristic spiral markings are more or less present, but indistinct in the specimen from Nepal; there are many attachments to the cup, and numerous free ends.

Hab. On dead wood.—Ceylon (B. M. 709); Nepal (K. 951); Mass. U.S. (L:B.M.159); Philadelphia (B. M. 950); Iowa (L:B.M.159).

8. A. flavus Pers., in Römer, N. Mag. Bot., i., p. 90 (1794). Plasmodium watery-white, in rotten wood. Sporangia cylindrical, stipitate, clustered, 1·5 to 2 mm. high, 0·3 to 0·5 mm. broad; ochraceous-yellow or pale buff. Cup of sporangium-wall membranous, flaccid, reticulated and often spinulose on the inner side, interruptedly plicate. Stalk short, or elongated and weak, filled with spore-like cells, buff. Capillitium a very elastic network of pale yellow, terete or flattened threads, 3 to 4 μ diam., expanding into a drooping column 8 to 12 mm. in length, free from the cup, or with few attachments; thickenings on the threads in the form of sharp spines and half-rings arranged in a loose spiral, and of scattered spinules and short lines of broken reticulation; free ends more or less numerous, with clavate tips. Spores pale yellow, nearly smooth, marked with a few scattered warts, 6 to 8 μ diam.—Trichia nutans Bull., Champ., p. 122, t. 502, f. 3 (1791). Arcyria nutans Grev., Fl. Edin., p. 455 (1824); Rost., Mon., p. 277; Cooke, Myx. Brit., p. 72; Blytt, Bidr. K. Norg., Sup. iii. (1892), p. 11; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 125; Mass., Mon., p. 150.

Plate LXIX., A.—a. empty sporangia seated on a common hypothallus, with expanded capillitium, × 20; b. capillitium, with portion of the cup of the sporangium, and spore, × 600 (England).

Hab. On dead wood.—Lyme Regis, Dorset (L:B.M.160); Leytonstone, Essex (L:B.M.160); Kent (B. M. 1151); Camden Town, London (B. M. 1152); Batheaston, Somerset (B. M. 289); Leicester (B. M. 284); Boynton, Yorkshire (B. M. 1148); France (B. M. 970); Germany (B. M. 722); Poland (Strassb. Herb.); Iowa (L:B.M.160); S. Carolina (B. M. 969).

9. A. Ørstedtii Rost., Mon., p. 278 (1875). Plasmodium watery-white, in hard wood of fir, etc. Sporangia cylindrical,
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curved, stipitate, clustered, rising from a common membranous hypothallus, 0.6 to 1.5 mm. high, 0.3 to 0.5 mm. broad, dull crimson; sporangium-wall evanescent above, with the exception of a few well defined rounded plates, which are papillose on the inner side, with a smooth margin; cup membranous, papillose with a smooth rim. Stalks varying in length, usually very short, weak, filled with spore-like cells, pale red. Capillitium a very elastic network of pale red, nearly terete threads, 3 to 5 μ diam., expanding into a drooping column three or four times the length of the sporangium; thickening in the form of sharp spines 1 to 3 μ long, more or less equally distributed, though the spiral arrangement is generally shown; threads attached at numerous points to the persistent plates of the sporangium-wall, with few attachments to the cup; free ends sometimes present with spinulose tips. Spores pale red, nearly smooth, marked with few scattered warts, 7 to 8 μ diam.—Cooke, Myx. Brit., fig. 196; Lister, in Journ. Bot. (1891), p. 266; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 125; Mass., Mon., p. 147. Hemiarcyria fuliginea Cooke & Massee, in Grev., xvi., p. 74. Arcyria fuliginea Mass., Mon., p. 169. Arcyria magna Rex, in Proc. Acad. Nat. Sci. Phil. (1893), p. 364.

Plate LXIX., B.—a. sporangia and expanded capillitium, × 9; b. shield-like persistent portion of sporangium-wall, with capillitium attached, × 180; c. capillitium with portion of cup of sporangium-wall, and spore, × 600 (England).

A specimen in Strassb. Herb. marked "Erstedt" is identical with the English gatherings of this species, as are also specimens from the United States received from Dr. Rex under the name of A. Erstedttii. Although nearly allied to A. flavia, it differs in the colour, and in the spines on the capillitium being more slender and closely set and more evenly distributed; it also differs in the presence of the well defined persistent portions of the sporangium-wall, which appears to be a very constant feature. Specimens received from different parts of the world possess the same characters with but little variation. The type specimen of Hemiarcyria fuliginea Cooke & Mass., from N. S. Wales (K. 154), has the capillitium attached to persistent papillose plates of the sporangium-wall, and is similar to the Lyme Regis gatherings of A. Erstedttii, except in the colour, which is now fuliginous-brown. The constrictions and ovoid swellings in the capillitium, mentioned by Rostafinski as characteristic of this species, are sometimes met with in Lyme Regis gatherings; they frequently occur in A. incarnata and other Arcyriae, and cannot be held to be of specific value.

Arcyria magna Rex, and A. magna var. rosea Rex, are represented by type specimens in the Museum (L:B.M.161); the expanded columns of capillitium are of the same form and dimensions as in A. Erstedttii, taking for comparison five growths of that species which developed from white plasmodium during two successive years on a fir-log at Lyme Regis. The two forms named as above were gathered from one log of timber, and though var. rosea is brighter in colour than the other, they are evidently the same species: the sculpture on the threads of the capillitium does not differ from that of the Strassburg specimen referred to more widely than frequently appears in different
gatherings of any other species of *Arcyria*; the cup of the sporangium-wall is indeed smooth or nearly so, but the persistent plates which are conspicuous in the var. *rosea* are papillose and similar to those in the Lyme Regis and Strassburg specimens of *A. Erstedtii* from which we are unable to detect a specific difference.

*Hab.* On dead wood.—Lyme Regis, Dorset (L:B.M.161); Sutton, Warwick (L:B.M.161); Germany (Strassb. Herb.); Denmark (K. 893); Norway (L:B.M.161); N. S. Wales (K. 154); Philadelphia (L:B.M.161).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**

10. *A. affinis* Rost., Mon., p. 276 (1875). Sporangia cylindro-ovoid, 1 mm. high, stalks 1 mm. high, crowded on the substratum; mass of spores and capillitium purple-red, or yellowish-red; net of capillitium free from the cup, consisting of cylindrical threads 3-6 µ diam. in the lower part, 5-4 µ diam. in the upper part; thickenings as in *A. incarnata*.

*Hab.* On tree trunks.—Sweden.

This description applies to the bright-coloured forms of *A. incarnata*.

11. *A. similis* Racib., in Rozpr. Mat. Przyr. Ak. Krak., xii., p. 81 (1884). Sporangia shortly stipitate, cherry-coloured. Capillitium free from the cup, consisting of thick-walled, cylindrical or slightly compressed threads 4-2 to 5-8 µ diam., marked everywhere with warts and raised bands; bands usually half-ringshaped, arranged not in spirals as in *A. adnata*, but quite irregularly, or with a few placed one over the other as in *A. ferruginea*, or in broken, irregular spirals; spores 7-5 to 8-3 µ diam., almost colourless, thin-walled, distinctly verruculose.

*Hab.* Near Cracow, Poland.

This description suggests a form of *A. incarnata*, in which species the markings on the capillitium are subject to great variation in shape and arrangement.

12. *A. irregularis* Racib., l.c., p. 83 (1884). Sporangia flesh-coloured, stipitate; stalks 0-5 mm. high, filled with colourless vesicles; cup hemispherical, the wall verruculose; capillitium forming an irregular network of flattened threads with undulate margins, 4-5 to 9-1 µ wide, 2-5 to 4-5 µ thick, densely beset throughout with irregular conical prominences, 0-8 to 1-5 µ broad, and usually elongated; spores 7 to 7-5 µ diam., with a firm, almost colourless wall.

*Hab.* On dead chestnut.—Near Cracow, Poland.

This description suggests also a form of *A. incarnata*.

13. *A. inermis* Racib., l.c., p. 82 (1884). Sporangia stalked, brick-red; the stalk filled with vesicles and capillitium threads; net of capillitium consisting of cylindrico-complanate threads, 4-2 to 10-8 µ wide, marked with thickenings forming a reticulation with meshes 1-6 to 2 µ long, and almost equally broad. Spores 9-9 to 10-8 µ diam., the wall firm, reddish, distinctly warted.
Hob. On rotten wood.—Near Cracow, Poland.

This description applies to *A. ferruginea*.

14. **A. Raciborskii** Berl., in Sacc. Syll., vii., p. 430. Sporangia stipitate, stalks filled with vesicles; cup hemispherical, the wall thin, reddish, densely and minutely warted on the inner side; capillitium forming a loose net, with globose swellings at the nodes and also in the internodes; threads in the lower part flattened, with one margin dentate, elsewhere smooth; threads in the upper part subcylindrical, with the teeth arranged in a spiral, the remainder of the thread marked with undulating ridges, forming one to four spirals; becoming in some parts indistinct, or branching to form an irregular reticulation; spores minutely warted, 10·5 to 11·6 μ diam.—*A. decipiens* Rac., l.c., p. 84 (non Berk.).

Hob. Near Cracow, Poland.

This description applies well to some forms of *A. ferruginea*.

15. **A. bonariensis** Speg., Ann. Soc. Cient. Argent., x., p. 151 (1880). Sporangia minute, 0·5 to 0·75 mm. high, 0·25 to 0·3 mm. broad, densely crowded in groups of 5 to 20, citron-yellow; the stalks half the height of the sporangium, concolorous; capillitium threads arising from the tube of the stalk, cylindrical, 3 μ diam., densely muricate, clear yellow-green; spores globose, granular, 10 μ diam.

Hob. On an old beam, Bonaria, Argentina. Allied to *A. nutans*, but quite distinct.


Hob. On willow, Hungary.

This description applies to *A. ferruginea*.

17. **A. aurantiaca** Raunk., in Bot. Tidssk. (1888), p. 61, tab. 3, figs. 4, 9, 10, 11. Sporangia gregarious, ovate or shortly cylindrical, stipitate; stalk the same length as the sporangium, or shorter; thickenings on the inner side of the receptacle in the form of fine warts; wall, capillitium and spore mass orange- or brick-red; tubes of the capillitium with irregularly connected close-standing ring-like thickenings, 5 to 7 μ broad; spores smooth, 10 to 11 μ diam.

Hob. On rotten wood.—Denmark.

The above description and figures clearly refer to *A. ferruginea*.
18. A. cornuvioides Racib., in Hedw., xxviii., p. 123 (1889). Sporangia bright cinnamon, obovate on short stalks 4 mm. high, or almost sessile and globose, 0·5 mm. diam., frequently confluent into irregular sessile plasmodiocarps, 3 mm. long, 2 mm. high; wall persistent in the lower part in the stalked forms as a flat cup marked with beautiful net-like thickenings on the inner side; capillitium threads 3 to 8 µ diam., much branched and anastomosing with few free ends, with band-like thickenings, either united to form a net, or scalariform, section of threads triangular or flattened; band-like thickenings not so regular as in A. ferruginea, much higher, often curved and suddenly disappearing; spores cinnamon in mass, smooth, 6·5 to 8·5 µ diam. The markings of the capillitium show near approach to A. ferruginea and A. inermis, and one might unite all three into a collective species: A. ferruginea has smooth spores 11 to 12 µ, A. inermis Rac. has the spores 10 to 12 µ, minutely warted.

Hab. On old trunks.—Poland.

SPECIES EXCLUDED FROM THE GENUS.

A. Bucknalli Mass. = Trichia scabra Rost.
A. clavata Mass. = Hemitrichia clavata Rost.
A. decipiens Berk. = Hemitrichia clavata Rost.
A. Hariotii Mass. = Lachnobolus circinans Rost.
A. Serpula Mass. = Hemitrichia Serpula Rost.
A. stipitata Mass. = Hemitrichia clavata Rost.

Genus 38.—LACHNOBOLUS Fries, Fl. Scan., p. 356 (1835). Sporangia sessile, clustered; sporangium-wall single, persistent, not thickened with angular granules; capillitium a loose network of cylindrical threads, with thickenings in the form of closely set warts.


Plate LXX., B.—a. sporangia, × 20; b. capillitium with portion of sporangium-wall and spores, × 600 (England).

The type specimen of *Arcyria Hariotii* Mass., in Paris Herb., is typical *L. circinans*.

_Hab._ On dead wood.—Haypit, Stafford (L: B.M. 162); Somerset (B. M. 291); France (Paris Herb.); Tyrol (Strassb. Herb.); Iowa (B. M. 1027, 1028).

**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**

2. **L. Arcyrella** Rost., Mon., p. 431 (1875). Sporangia pyriform, fulvous or almost straw-coloured; stalk about as long as the sporangium, yellowish; capillitium not elastically expanding, forming a lax irregular network, threads 2·5 to 8·3 μ diam., attached at many points to the sporangium-wall, some threads descending into the tube of the stem, marked with numerous small obtuse warts; spores smooth, 7 to 8 μ diam.

_Hab._ Jutland.

This description applies to *Arcyria albida*.

3. **L. Rostafinskii** Racib., in Rozpr. Mat.-Przyr. Ak. Krak., xii., p. 80 (1884). Sporangia stipitate, ovoid-conical, apex rounded, yellowish-grey, the lower part of the sporangium with a distinct membrane, hemispheric-patelliform, the upper part destitute of a membrane; capillitium well developed, forming a net adnate to the sporangium-wall by numerous attachments, the upper part with many free rounded ends; threads 4·2 to 8·2 μ diam., marked with slender ridge-like processes forming a reticulation; spores smooth, yellowish, almost colourless, 7·5 to 8·3 μ diam.

_Hab._ On dead birch roots.—Near Cracow, Poland.

This description suggests a form of *Arcyria flava* Pers., in which developments sometimes occur closely corresponding with the above account.

**SPECIES EXCLUDED FROM THE GENUS.**


Genus 39.—**PERICHÆNA** Fries, Symb. Gaster., p. 11 (1817). Sporangia sessile, subglobose or plasmodiocarps; sporangium-wall of two layers, the outer thickened with dark angular granules, which are exceptionally absent in the upper part, the inner membranous; capillitium of branching or simple threads, spinose, minutely warty, or nearly smooth, marked with irregular constrictions; spores yellow, minutely warty.
KEY TO THE SPECIES OF _PERICHÆNA_.

_A_. Sporangium-wall stout, brown, black or grey, inner layer smooth.

Capillitium spinose, abundant. 1. _P. chrysosperma_

Capillitium minutely warted, abundant; spores 10 to 11 μ diam. 2. _P. depressa_

Capillitium minutely warted or nearly smooth, scantly; spores 12 to 14 μ diam. 3. _P. populinia_

_B_. Sporangium-wall yellow or pale umber, inner layer papillose.

4. _P. variabilis_


Plate LXXI., _A._—_a_, sporangia, stalked and sessile, x 20; _b_, capillitium from different sporangia growing on the same piece of walnut bark, and spore, x 600 (England).

It would appear that Rostafinski excluded this species, which he named _Cornuvia circumscissa_, from the genus _Perichæna_, because he defined that genus as having capillitium without characteristic thickenings; but in _P. populinia_, to which this definition most nearly applies, the capillitium is usually closely warted and notched, rarely smooth, while in some gatherings the threads are beset with scattered sharp spines in addition to crowded spinules. In _P. depressa_ and _P. vermicularis_ the capillitium is never smooth, though the thickenings may be reduced to minute warts; the character given by Rostafinski is therefore inapplicable, and in every feature except the large development of spines on the threads, _P. chrysosperma_ is closely allied to the other members of the group. In a gathering of this species at Lyme Regis, two of the sporangia examined have smooth threads with a few minute spines distinctly scattered, in others the spines are of the usual form, loosely set, and about 2·5 μ long; but in the greater number of sporangia the spines measure 5 to 6·5 μ in length. The characters
of this gathering embrace the varieties given as "a. scabra" and "β. spinosa" by Schreeter, and also those of the numerous specimens of Cornuaria Wrightii Rost., from the United States, including the type from Cuba gathered by Wright. A specimen from Mr. Morgan, from Ohio, stands alone in having small spores 7 to 8 μ diam.; in other respects it is typical.

The circumscisile form of the sporangia is not met with in any of the collections, or in my own gatherings. From the original account of Trichia circumscissa by Wallroth, it is possible that the specimen described by him was Perichæna depressa; the specific name given by Currey is therefore here adopted.

Hab. On dead bark.—Lyme Regis, Dorset (L:B.M.163); Herb. Broome (B. M. 308); Ceylon (K. 1712); Philadelphia (L:B.M.163); Ohio (L:B.M.163); Iowa (L:B.M.163); Cuba (B. M. 699).


Plate LXXI., B.—a. sporangia, × 20; b. capillitium, × 280; c. capillitium and spore, × 600 (England).

The type specimen of P. applanata Mass., from Brisbane (K. 153), is characterised by the outer layer of the sporangium-wall having a superficial crust of angular crystals of lime, which gives the sporangia a lilac-grey colour; in all other respects, in the abundant and minutely warted capillitium, and in the spores measuring 10 to 12 μ diam., it agrees with P. depressa. Deposits of lime on the sporangium-wall are of frequent occurrence both in the latter species and in P. populina, and although they are unusually abundant in the Brisbane specimen, the character is not of sufficient importance to give specific distinction. The type specimen of P. artocreas Berk. & Rav. from S. Carolina (K. 1027 and B. M. 697) appears to be P. depressa with abundant capillitium, and spores measuring 8 to 10 μ; the sporangia are polygonal, depressed, pale brown; the inner layer of the sporangium-wall is smooth, and not papillose as in P. variabilis. The type specimen of P. irregularis Berk. & Curt. from S. Carolina (K. 1706) is typical P. depressa. A type specimen of Stegasma australis Ces. (B. M. 1034), is in imperfect condition, but it appears to be P. depressa from the many broken pieces of minutely warted capillitium, and the spores, which measure 10 to 11 μ diam.
Hab. On dead wood and bark.—Epping Forest, Essex (L.B.M.164); Lyme Regis, Dorset (I:B.M.164); Leicestershire (B. M. 696); Glamis, Scotland (B. M. 323); Belgium (B. M. 690); Germany (B. M. 688); Italy (B. M. 689); Poland (Strassb. Herb.); Australia (K. 153); Philadelphia (L:B.M.164); Ohio (L:B.M.164); S. Carolina (B. M. 697, 986).

3. P. populina Fries, Symb. Gaster., p. 12 (1817). Plasmodium watery-grey, in decaying bark. Sporangia globose, depressed, ellipsoid, or forming short broad plasmodiocytes, crowded, sessile on a broad or narrow base, rarely subtipitate, 0.5 to 1 mm. diam., dark purple or purplish-brown, nut-brown, grey or white, dehiscing along definite lines, either horizontally with a convex lid or in broad sinusous lobes; sporangium-wall of two layers, the outer cartilaginous, opaque, charged with brown granular matter intermixed with acicular or angular calcareous deposits which form a pruinose or crystalline covering in the grey and white sporangia; inner layer membranous, usually closely combined with the outer. Capillitium scanty or almost wanting, consisting of slender, branched or simple, yellow threads, 1.5 to 4 μ diam., irregularly compressed, angled and constricted, minutely warted, rarely smooth; attached to the sporangium-wall or free. Spores yellow, more or less minutely warted, 12 to 14 μ diam.—Lycomperdon corticale Batsch, Elench. Fung., p. 155 (1783). Perichæna corticalis Rost., Mon., p. 293, fig. 188; Cooke, Myx. Brit., p. 78; Zopf, in Schenk, Handbuch der Botanik, iii., 2, p. 169; Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 10; Machride, in Bull. Nat. Hist. Iowa, ii., p. 120; Mass., Mon., p. 115. Trichia fusco-atra Sibth., Fl. Oxon, p. 407 (1794). Perichæna fusco-atra Rost., Mon., p. 294; Cooke, Myx. Brit., p. 78. Licea pannorum Cienk. (non Wallr.), Pringsh., Jahrb., iii., p. 407. Perichæna liceoides Rost., Mon., p. 295; Mass., Mon., p. 118. Oligonema Broomei Mass., in Journ. R. Micr. Soc. (1889), p. 346; Mass., Mon., p. 172.

Plate LXXII. A.—a. sporangia, × 20; b. capillitium and portion of sporangium-wall, × 280; c. capillitium and spore, × 600 (England).

In large developments from one plasmodium on the inner side of the bark of old stumps, every variety of form is sometimes represented, from broad plasmodiocytes to globose and subtipitate sporangia, and the colour may range from deep purple to grey. In gatherings where the colour is pure white, the outer layer of the sporangium-wall consists of crystalline deposits of lime without the intermixtures of brown granules. The capillitium is subject to much variation according to the season of the year and other causes. In a gathering at Lyme Regis in the autumn, the capillitium was scanty, forming a net of rugged coarsely warted threads 2 to 4 μ diam., with a few scattered free threads; in the following spring another growth on the same pieces of bark had sporangia of a similar shape and colour, but with a more abundant capillitium forming a freely branching slender network of minutely warted threads 1 to 1.5 μ diam., scarcely differing from that of P. depressa, the larger spores being the chief character which distinguished the gathering from that species. The specimens
of *P. fusco-atra* in the collections differ in no respect from forms of *P. populina*, and cannot be held as specifically distinct. The type specimen of *Oligonema Broomei* Mass. from Warleigh (B. M. 364) is typical *P. populina* with characteristic branching capillitium threads marked with irregular swellings and spinules, and with minutely and closely warted spores 14 to 15 μ diam. The specimen described by Cienkowski as *Licea pannorum*, l.c., is given by Rostafinski as the type of a new species, *Perichæa liceoides*, characterised by the scanty capillitium of free threads and the spores measuring 9 to 10 μ; Zopf, on the other hand, quotes it as a synonym for *P. populina*; and this view is confirmed by the not infrequent occurrence of forms of the latter species with scanty or no capillitium, and spores measuring from 10 to 12 μ.

**Hab.** On dead wood and bark.—Batheaston, Somerset (B. M. 309, 320); Shrewsbury (B. M. 322); Lyme Regis, Dorset (L:B:M.165); Salisbury (L:B:M.165); Brentwood, Essex (L:B:M.165); Boynton, Yorkshire (B. M. 1160); Tregayan, Anglesey (B. M.); France (B. M. 1161); Germany (B. M. 653); Finland (B. M. 767); Sweden (K. 1702); Tasmania (K. 1710); Philadelphia (L:B:M.165); Ohio (L:B:M.165); Florida (B. M. 987).


Plate LXXII. B. a. sporangia, × 20; b. portion of papilllose wall of the upper part of the sporangium, × 280; c. capillitium and spores, × 280; d. capillitium and spore, × 600 (England).

The yellow form of this species has appeared in some abundance in successive years at Lyme Regis, and corresponds exactly with the type specimen of *Physarum vermiculare* from Schweinitz (K. 1671). The German type of *P. variabilis* is not represented in the Strassburg or British collections, but examination of the type of *Ophiothea umbrina* from Curtis (K. 1705), which is given as a synonym for *P. variabilis* by Rostafinski (Mon., App., p. 35) shows that it is a pale umber, plasmodiocarp form, agreeing in the structure of the sporangium-wall, capillitium, and spores with the English gatherings. *P. Friesiana* Rost. is described as differing from *P. variabilis* in the
former having a double and the latter a single sporangium-wall; but
this character is inconstant, as mentioned in the text. The specimen
from Ellis, No. 726, N. Am. Fungi (K. 990), originally named P.
Friesiana, and then O. umbrina, resembles the Lyme Regis gatherings
and Rostafinski's description of his German types of P. variabilis. The
specimen from Ellis and that from Lyme Regis (K. 991) are given as
the types of a new species, P. confusa Mass.; but surely on insufficient
grounds. The type of Licea reticulata Berk. & Br., from Ceylon
(L:B.M.166) is also P. variabilis; the sporangia consist of minute pale
umber, net-like plasmodiocarps, some of which have very scanty
capillitium, but in others it is more abundant and of the usual
minutely warted type; the spores are closely and minutely warted
and measure 11 to 15 μ. In all the specimens enumerated above, the
inner layer of the sporangium-wall is minutely papillose, a character
by which this species of Perichæna is distinguished from all others.

Hab. On dead leaves, wood, etc.—Lyme Regis, Dorset (L:B.M.166);
Batheaston (B. M. 310, 311); Luton, Beds (L:B.M.166); Ceylon
(L:B.M.166); New Jersey (K. 990); Philadelphia (L:B.M.166);
N. Carolina (K. 1671, 1705); S. Carolina (B. M. 953).

SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.

(1879), p. 130. Sporangia scattered and subgregarious, sessile,
globose, yellowish-brown, shining. Capillitium wanting. Spores
globose, almost smooth, dark or blackish brown, brownish under
the microscope, 10 to 27 μ diam.

Hab. On moss and dead leaves.—Finland.

This description suggests an imperfect development of P. populina.

Sporangia solitary or in small groups, subglobose, 0·5 mm. diam.,
more rarely irregular, depressed, yellowish-brown, smooth,
opaque, dehiscing irregularly; capillitium abundant, forming a
regular lax net of yellow threads, 1·5 to 2 μ diam., somewhat
wider at the angles. Spores golden-yellow, strongly spinose,
15 to 17 μ diam.

Hab. On dead leaves.—Breslau, Silesia.

gregarious, pale tan-coloured; spores yellow, but paler than in
P. australis.—Stegasma pallida Cesati, Atti Accad. Sc. Fis. Mat.,
viii., p. 12 (1879).

Hab. Sarawak, Borneo.

This description is too brief to be of use.

Sporangia clustered on a thin yellow-grey hypothallus, globose,
hemispherical or reniform, sessile, 0·5 mm. diam., bright yellow-
grey, dehiscing more or less regularly with a lid; the wall
thickly encrusted with numerous round, angular, or rod-shaped bodies, only very partially consisting of lime, the upper part marked on the inside with delicate bands forming a regular reticulation with 5 to 6 angled meshes, 12 μ diam. Capillitium scarcely evident, consisting of few weak, simple, or branched yellowish threads 1·5 to 2 μ diam., unequally warted. Spores golden-yellow, delicately warted, delicately spinulose, of equal breadth throughout, 10 to 12 μ diam.

_Hab._ On beech bark.—Denmark.

This description applies perfectly to forms of _P. populina_ with scanty capillitium.

9. _P. nitens_ Raunk., _l.c._, p. 55. Sporangia solitary or clustered, globose-pyiform, sessile or shortly stipitate, dehiscing irregularly, greyish-brown with a violet metallic lustre, 0·5 mm. diam.; wall single, almost without deposits of granules. Capillitium of long weak threads, slightly branched, attached to the sporangium-wall by irregular enlargements, unequally and delicately spinulose, of equal breadth throughout, 1 to 1·5 μ diam. Spores delicately spinulose, yellowish, 10 to 12 μ diam.

This description suggests a small-spored form of _P. populina._

10. _P. Krupii_ Racib., in Hedw., _xxviii._, p. 124 (1889). Sporangia chestnut-brown, rarely globose, depressed, solitary, usually flat creeping plasmodiocarps, irregularly ring-shaped or vermiform, 0·5 to 1·2 mm. long, plasmodiocarps as much as 15 mm. in length, 0·5 to 0·75 mm. high; sporangium-wall simple, iridescent, chestnut-brown, finely warted, breaking away as a lid in the upper part. Capillitium forming a dense web of rather thick-walled threads, 0·3 to 1·5 μ diam., covered with crowded irregularly shaped, wart-like thickenings giving a toothed appearance, without constrictions, rarely branching; capillitium connected with the sporangium-wall by many thin smooth connecting threads. Besides these there are small, short or long outgrowths from the sporangium-wall 2 to 12 μ long, 1 to 3 μ thick, 200 to 500 on a square millimetre of the wall. Spores globose, brownish-yellow, minutely warted, 7 to 8·5 μ diam.

_Hab._ On bark.—Tatra Mounts, Poland.

This description suggests a species of _Dianema,_ possibly _D. corticatum._

11. _P._ ? _pseudæcidium_ Speg., in Ann. Soc. Cient. Argent., _xxii._, p. 187 (1886). Sporangia cylindrical, conical, or calyciform, 1 to 1·5 mm. long, 0·5 to 1 mm. broad, sessile or shortly stipitate, wall very thin cartilagino-membranaceous, base even or minutely rugulose, dehiscing at the apex in an irregularly laciniate or fimbriate manner, chestnut or brownish; mass of spores and capillitium citron or yellowish; capillitium threads very slender, 1 μ thick, sparingly branched here and there with solitary conical or elongated branch-like spines, yellowish; hyaline. Spores
globose, 6 to 7 μ diam., often irregularly angled from mutual pressure, smooth, pale vinous with a yellow tinge.

_Hab._ On living fronds of many species of fern and on _Tillandsia muscoides._—Argentine Republic. A beautiful but paradoxical species, exactly resembling a folicolous _Æcidium_; it will probably form the type of a new genus.

From the description of the fimbriate sporangium-wall, mycelium-like capillitium threads and angular spores, it is possible that this species does not belong to the _Mycetozoa._

**EXCLUDED FROM THE MYCETOZOA.**

_P. strobilina_ Fr., _P. decipiens_ Berk. & Br., and _P. picea_ Berk. & Br.

Order III.—_Margaritaceæ._ Sporangia normally sessile, sporangium-wall single, smooth, translucent; capillitium abundant, not consisting of separate elaters nor combined into a net; spores pinkish or yellowish-grey.

**KEY TO THE GENERA OF MARGARITACEÆ.**

Capillitium profuse, long, coiled, hair-like, 0.5 to 2 μ thick.

(40) _Margarita._

Fig. 48.—_Margarita metallica_ Lister.

_a._ Two sporangia. Magnified 6 times.

_b._ Part of a long capillitium thread, and a spore. Magnified 250 times.

Capillitium of nearly straight threads, without spiral thickenings, attached at both ends to the sporangium-wall.

(41) _Dianema._

Fig. 49.—_Dianema depressum_ Lister.

_a._ Plasmodiocarp. Magnified twice.

_b._ Capillitium attached above and below to the walls of the sporangium. Magnified 50 times.

_c._ Spore. Magnified 560 times.
Capillitium of fasciculate threads, penicillate and slender above, marked with spiral thickenings, attached above and below to the sporangium-wall.

(42) Prototrichia.

Fig. 50.—Prototrichia flagellifera Rost.

a. Group of sporangia. Magnified 4 times.
b. Capillitium attached above to a fragment of the sporangium-wall, and a spore. Magnified 280 times.

Genus 40.—Margarita Lister, gen. nov. Sporangia globose; capillitium a profuse web of coiled hair-like, sparingly-branched, slender, solid threads, with indistinct attachments to the sporangium-wall.

1. M. metallica Lister. Plasmodium watery-white, among dead leaves and rotten wood. Sporangia globose, sessile on a narrow base, 0.5 to 1 mm. diam., solitary or gregarious, pearl-grey or copper-coloured, shining, iridescent; sporangium-wall single, somewhat tough, glaucous or yellowish, translucent. Capillitium a profuse web of very long, even, solid, grey or yellowish threads, 0.5 to 1 μ diam., increasing in some parts to 2 μ, scarcely branching, with few attachments to the sporangium-wall or apparently free. Spores pale yellow or nearly colourless, minutely warty, 10 to 11 μ diam.—Physarum metallicum Berk. & Br., in Mag. Zool. and Bot., i., p. 49 (1838). Cornuvia metallica Rost., Mon., App., p. 35; Cooke, Myx. Brit., p. 76. Perichaena plasmodiocarpa Blytt, Bidr. K. Norg., Sop. iii. (1892), p. 10.

Plate LXXIII., A.—a. sporangia, × 20; b. capillitium, showing the bulbous end of a delicate thread adhering to a portion of the sporangium-wall, and spores, × 280; c. capillitium and spore, × 600 (Engl.

The capillitium is usually papillose on one side of the waved thread. The spores vary in roughness from being distinctly warted to nearly smooth. In gatherings from Lyme Regis, Dorset, and Wanstead, Essex, the sporangia are scattered or crowded, pearly grey or iridescent bronze; those in Broome's collection, British Museum, are more or less coppery. In specimens submitted by Prof. Blytt, of Christiania, they are subglobose, and crowded with broad bases on a common hypothallus; the colour is bright copper, resembling some of Broome's specimens; the capillitium and spores are similar to those in the English gatherings. This species has been removed from the genus Cornuvia on account of the remote connection it holds with C. Serpula, which at present may be considered the sole representative of that genus. The name Margarita is given to the genus on account of the pearl-like appearance of the sporangia.

Hab. On dead leaves, sticks, etc.—Batheaston, Somerset (B. M. 94, 95, 98, 272); Wanstead, Essex (L:B.M.167); Lyme Regis, Dorset (L:B.M.167); Birmingham (L:B.M.167); Norway (L:B.M.167).
Genus 41.—**Dianema** Rex, in Proc. Acad. Nat. Sc. Phil., p. 397 (1891). Sporangia simple, often forming plasmodiocarps, depressed, sporangium-wall membranous, without lime; capillitium abundant, of nearly straight threads without spiral thickenings, attached at both ends to the sporangium-wall.

**KEY TO THE SPECIES OF DIANEMA.**

Sporangium-wall translucent, spores free—

   Spores minutely warted.
2. *D. depressum* Lister. 
   Spores reticulated.
   Sporangium-wall granular, spores clustered, minutely warted

1. *D. Harveyi* Rex, l.c. Plasmodium? Sporangia sessile, rounded or cushion-shaped, flattened above, averaging 1 mm. in diam., 0·35 mm. in height, sometimes elongated and bent into an irregular horse-shoe shape, dull red or gold-bronze, with a metallic lustre; sporangium-wall membranous, thin, translucent, beset with the persistent ends of the capillitium when the rest of the threads have broken away. Capillitium of numerous slender, brownish-yellow threads, 1·5 to 2 μ diam., not connected with each other, simple or sparingly branched, forked two or three times near their origin or insertion, nearly parallel, straight or flexuose, running from the base to the upper wall of the sporangium. Spores pale yellow, minutely warted 8 to 10 μ diam.

Plate LXXIV., A.—a, sporangia, × 20; b, capillitium, showing attachment of the threads to the base and upper wall of the sporangium, and spores, × 250; c, spores, × 600 (England).

The specimen figured is taken from a gathering of eighteen sporangia on an ash stick near Lyme Regis, in the spring of 1894. They agree with the type from America in capillitium and spores, but the colour of the sporangia is dull brick-red. By the light of these specimens, that in Broome’s Collection (B.M. 94) marked *Physarum metallicum*, is clearly the same species; it is in a fragile condition, and as the capillitium breaks up when mounted, the characters are difficult to recognise; but the numerous broken points of attachment to the base and upper wall of the sporangium, together with the minutely warted spores, leave no doubt of its identity. The date and locality are not given by Broome, but it is probable that it was gathered at Batheaston in 1869 or 1870, as it stands in his collection among other specimens correctly marked *Physarum metallicum* gathered there at that date.

Hab. On dead wood.—Lyme Regis, Dorset (L:B.M.168); Maine (L:B.M.168 slide).

2. *D. depressum* Lister. Plasmodium white, rarely rosy red, in rotten apple logs, ash sticks, etc. Sporangia forming sessile, pulvinate, depressed, broad plasmodiocarps, 2 to 10 mm. wide, about 0·3 mm. thick, when immature shining violet, ripening to grey brown; sporangium-wall a smooth, translucent, yellowish-grey membrane, beset with the persistent ends of the capillitium when the rest of the threads have fallen away. Capillitium
MARGARITACEÆ

profuse, consisting of pale yellowish-grey, straight, rigid, slender threads. 0·5 to 2 μ thick, forking at an acute angle, connected with each other at the opposite ends, or fasciculate, without free branches, minutely papillose on one side, attached above and below to the sporangium-wall by the suddenly acuminate extremities. Spores pale yellowish-grey, closely reticulated over the greater part of the surface with raised bands, forming a border 0·5 to 1 μ broad, the remaining part marked with broken or very loose reticulation, 6 to 8 μ diam.—Cornuviæ depressa List., in Journ. Bot. (1891), p. 265.

Plate LXXIV., B.—a. sporangium, × 20; b. capillitium, showing attachment of the threads to the base and upper wall of the sporangium, and spores, × 280; c. capillitium and spores, × 600 (England).

A description of this species was given in Journ. of Botany, l.c., under the name of Cornuviæ depressa, on account of its affinity with Margarita metallica, which at that time was included in the genus Cornuviæ. Dr. Rex having since established the genus Dianema for the closely allied American species, it is here adopted as in every way the more appropriate position for this species.

Hab. On dead wood.—Batheaston, Somerset (B. M. 2, 3, 4, 5, 96, 300); St. Catherines (B. M. 19a); Rudloe, Wilts (B. M. 19); Lyme Regis, Dorset (L:B:M. 169).

3. D. corticatum List., sp. nov. Plasmodium pink. Sporangium hemispherical, 1 mm. diam., more often forming ring-shaped, elongated, or netlike plasmodiocarps 3 to 12 mm. long; shining or opaque, chestnut or lurid brown; sporangium-wall ochraceous-olive, composed of two layers, the outer densely granular, the inner hyaline. Capillitium somewhat sparse, consisting of simple or acutely branching, slender, brown and pale threads, 0·5—1·5 μ diam., often with distant beadlike thickenings, either nearly smooth or marked with a single prominent spiral band, occasionally for a short distance with three bands; the threads are attached above and below by very delicate extremities to the sporangium-wall. Spores brownish-pink in mass, nearly colourless when highly magnified, subelliptical, adhering in clusters of 4 to 6, minutely warted on the outer side, 10 to 12 × 8 to 9 μ diam.

Plate LXXVII., B.—a. plasmodiocarp, × 20; b. capillitium attached to fragment of sporangium-wall, and clustered spores, × 280; c. capillitium, × 600; d. spores, × 600 (Norway).

This species was found in some abundance on rotten planks at Sande, Norway, September, 1894, in company with Licea flexuosa, to which it bears a strong resemblance under a pocket lens. It holds an intermediate position between the genera Dianema and Prototrichia, having the general features of the former, but exhibiting in some sporangia the spiral bands on the capillitium characteristic of the latter. It differs from the species hitherto comprised in both genera in the more substantial sporangium-wall and in the clustered spores. The description of Perichæna Krupii Racib. (see p. 201) may possibly refer to this species.

Hab. On rotten wood.—Norway (L:B:M. 174).
Genus 42.—**PROTOTRICHIA** Rostafinski, Mon., App., p. 38, 1876. Sporangia normally sessile, globose; capillitium of fasciculate threads, penicillate and slender above, marked with spiral thickenings, attached above and below to the sporangium-wall.


Plate LXXIII, B.—*a.* sporangia, × 20; *b.* part of a strand of capillitium, and spores, × 280; *c.* part of the base of a sporangium, showing the attachments of the strands of capillitium, × 280; *d.* capillitium and spore, × 600 (England).

*P. flagellifera* occurs abundantly in the neighbourhood of Lyme Regis, in a larch plantation, where it has been gathered for several years, in the autumn and winter, on dead brambles and sticks. It is a species that is subject to considerable variation from changes of temperature and weather. In the most perfect development the strands of the capillitium are deep red-brown, sharply marked with regular and close spiral bands, springing erect, but with intertwining branches as far as the upper third, where they divide into a brush of more slender straight threads, and the spores are pale pinkish-brown, distinctly warded. Where the development has been checked by cold or dry weather, the threads are pale olive, with irregular or lax branches and indistinct spiral markings; or the spiral character may be wanting, replaced by broad or narrow rings. Associated with this form the spores are paler and more yellow, and faintly warded or nearly smooth. In cultivations, when the plasmodium has been shaken in conveying it from the wood, the capillitium forms very irregularly, sometimes anastomosing with broad and flat expansions with no appearance of spirals. Similar specimens have been received from Mr. Camm, Smethwick, in spring gatherings after cold weather: this is the form described under the name of *Prototrichia chamaeleontina* Mass.; it is entirely different from *Cornuva metallica* Rost., which is given as a synonym by that author. The gathering from Badminton (K. 1740, B. M. 333),
referred to by Rostafinski as a type of *P. flagellifera*, is the form with olivaceous capillitium and nearly smooth spores. The type of *Trichia metallica* Berk., from Tasmania (K. 1741), is almost destroyed, but the spores and sporangium-wall indicate that it was of the Badminton form. The type of *P. elegantula* Rost., from Sweden (K. 1743), is a more perfect development with distinctly warded spores. *P. cuprea* Mass., from Scarborough and Carlisle (K. 1744, 1745), is a frequent form with minutely warded spores, and is similar to specimens of *P. flagellifera* in Broome's collection. The large gatherings from Lyme Regis, showing all degrees of variation, demonstrate that the specimens in the collections to which different names have been given represent one species, whose diverging forms are too inconstant to be defined even as varieties.

_Hab._ On dead sticks, bark, etc.—Batheaston, Somerset (B. M. 324 to 331); Badminton, Gloucester (B. M. 333); Lyme Regis, Dorset (L.B.M.170); Smethwick, Stafford (L:B.M.170); Berwick (Phillips' Coll.); Sweden (K. 1743); Norway (Christiania Herb.); Tasmania (K. 1741).

**SPECIES EXCLUDED FROM THE GENUS.**

*P. Bombarda* Mass. = _Alwisia Bombardii_ Berk. & Br.

Order IV.—LYCOGALACEÆ. Sporangia forming an aethalium; capillitium consisting of even or wrinkled branching colourless tubes.

This order contains the single genus *Lycogala*.

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Fig. 51.—*Lycogala miniatum* Pers.

_a_. Three aethalia. Natural size.

_b_. Capillitium. Magnified 150 times.

_c_. Spore. Magnified 600 times.

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Genus 43.—LYCOGALA Micheli, Nov. Pl. Gen., p. 215 (1729). Aethalia subglobose or conical, with a cortex consisting of two or more closely combined layers of different structure, the outer containing large cell-like vesicles, either enclosed or superficial, and traversed by interlacing double-walled threads, which penetrate the homogeneous inner layer at numerous points, their inner walls only being continuous with the tubes of the capillitium; capillitium grey or colourless, of wrinkled or nearly smooth branching tubes, attached to all parts of the cortex, with numerous rounded free ends. Isolated vesicles filled with granular matter are often found scattered among the spores.

The plasmodium of *Lycogala miniatum* first rises from the wood as a group of small coral-red papillae, which soon extend to form a cushion-like mass of closely convoluted veins or sporangia; these are
more or less separated from each other by narrow tubular air-passages. Sections of such an æthalium, when hardened and stained, show the inner veins to measure from 40 to 50 μ diam., while the more superficial veins are about 100 μ diam. At a later stage the outer convolutions become deeply lobed, flattened and folded on themselves; tubular air-passages are enclosed between the folds, which, together with the deeper air-passages and the surface of the æthalium, are bounded by a delicate membrane. At a still later stage, when the cortex is forming, the periphery is differentiated into two layers, an outer and an inner. The former bears on its surface isolated thick-walled lobes or vesicles, 20 to 200 μ diam., containing nucleated, deeply-staining protoplasm; the nuclei remain sharply defined till after the spores are formed in the æthalium, when they degenerate and disappear. This outer layer consists of unstaining, hyaline substance, destitute of nuclei, and traversed by thick-walled interlacing air-passages. The inner layer is finely granular, faintly staining, homogeneous, and devoid of nuclei; through it the air-passages of the cortex communicate with those of the interior; the latter remain thin-walled, and form the so-called capillitium. In examining a young æthalium after the cortex has formed, but some hours before the karyokinetic division of nuclei, preparatory to the formation of spores, takes place, the capillitium tubes are found to be completely formed, and are filled with air, though lying in the fluid sporeplasm. This appearance shows that they are the air-spaces which existed among the convoluted sporangia when producing the æthalium, bounded by a membrane corresponding to sporangium-walls. In L. flavo-fuscum this membrane is more delicate than in L. miniatum, and is in some parts perforated with irregular lattice-work openings. The presence of spores in the tubes, which is occasionally found in L. flavo-fuscum, may be explained by the penetration of sporeplasm through such openings.

KEY TO THE SPECIES OF LYCOCALA.

Cortex of æthalium smooth or areolated.

1. L. flavo-fuscum

Cortex of æthalium warted—

Æthalia subglobose.

Æthalia conical.

2. L. miniatum

3. L. conicum

1. L. flavo-fuscum Rost., Versuch., p. 3 (1873). Plasmodium? Æthalia rounded, sessile, or subpyriform, and shortly stalked, 2 to 5 cm. diam., ochraceous-brown or purplish-brown, smooth, minutely areolated; cortex thick, of three layers, the outer membranous, the middle consisting of a dense aggregation of yellow vesicles, 50 to 80 μ diam., intermixed with the peripheral ends of the capillitium, the inner layer homogeneous, pierced by the capillitium threads; mass of capillitium and spores pale buff. Capillitium of irregularly branching, nearly colourless, wrinkled tubes, 6 to 20 μ diam., or more, with numerous blunt-ended free branches. Spores almost colourless, minutely reticulated over the greater part of the surface, 5 to 6 μ diam.—Mon., p. 288; Cooke, Myx. Brit., p. 76; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 127; Mass. Mon., p. 124; Zopf, in Schenk, Handb. der Bot., iii., 2, p. 167. Diphtherium flavo-fuscum Ehrenberg, Sylv. Myc. Berol., pp. 14, 27 (1818).
Plate LXXV., A.—a. aethalium, natural size; b. reticulated surface of cortex, × 20; c. vertical section of cortex; (1) outer layer composed of interwoven, empty, flattened tubes; (2) vesicles containing yellow or reddish-yellow matter, with the interspaces between them traversed by tubular processes, which are more or less continuous with the capillitium; (3) homogeneous inner layer, perforated by the capillitium, × 80; d. capillitium consisting of empty tubes, occasionally containing spores in the rounded ends and in limited spaces in the continuity of the tubes, × 80; e. part of capillitium tube, showing the papilllose surface, × 600; f. spores, showing unequally distributed reticulation, × 600 (N. America).

American specimens received from Dr. Rex and Prof. Macbride are identical in structure with those in the Strassburg Herbarium.

Hab. On dead wood.—Germany (Strassb. Herb.); Ceylon (K. 1732); Philadelphia (L.B.M.171); Ohio (L.B.M.171); Iowa (B. M. 827); S. Carolina (B. M. 838).

2. L. miniatum Pers., in Römer, N. Mag. Bot., i., p. 87 (1794). Plasmodium rose-red, in rotten wood. Sporangia subglobose, sessile, crowded or scattered, 2 mm. to 1 cm. diam., pinkish-grey, yellowish-brown or red-brown, minutely warted; cortex varying in thickness, with superficial vesicles. Capillitium arising from all parts of the inner side of the cortex in loosely branching and anastomosing, thin-walled tubes, varying from 3 to 20 μ diam., more or less wrinkled, with numerous free branches, clavate or rounded at the ends; mass of capillitium and spores pinkish grey. Spores almost colourless, closely reticulated over the greater part of the surface, the remaining part marked with a loose reticulation, or with short raised lines and warts, 5 to 7 μ diam.—Nees, Syst. Pilze, p. 103; Grev., Sc. Crypt. Fl., t. 38. *Lycoperdon Epiderdrium* Linn., Sp. Pl., ii., p. 1184 (1753). *Lycogala Epiderdrium* Rost., Versuch., p. 3 (1873); Mon., p. 285 (1875); Cooke, Myx. Brit., p. 75; Zopf, in Schenk, Handb. der Bot., iii., 2, p. 168; Blytt, Bidr. K. Norg., Sop. iii., p. 12; Macbride, in Bull. Nat. Hist. Iowa, ii., p. 127; Mass., Mon., p. 121.

Plate LXXV., B.—a. sporangia, natural size; b. surface of cortex, warted with vesicles, × 20; c. vertical section of cortex; (1) upper layer containing interwoven thick-walled tubes, and bearing on the surface simple or compound vesicles; (2) homogeneous inner layer, perforated by the capillitium, × 80; d. capillitium, consisting of empty tubes, rugose with ridges and folds, × 180; e. part of capillitium tube, and spores, × 600 (England).

In small aethalia the cortex is usually thin, the interlacing threads in the outer layer narrow and scanty, and the homogeneous inner layer membranous; in larger aethalia the outer layer is often 40 μ thick, and the interlacing threads broad and abundant. with gelatinous outer walls 5 to 10 μ thick: while the homogeneous inner layer sometimes exceeds 50 μ in thickness.

Hab. On dead wood. Common.—Wilts (B. M. 1, 6); Lyme Regis, Dorset (L:B.M.172); Orton Wood, Leicestershire (B.M.); France (B. M. 733); Germany (B. M. 728); Poland (Strassb. Herb.); Norway (B. M. 734); Finland (B. M. 732); Italy (B. M. 737); Bermuda (B. M. 745); Philadelphia (L:B.M.172); Iowa (L:B.M.172); Island of St. Thomas, Africa (B. M. 1156); Ohio (L:B.M.172); S. Carolina (B. M. 841); Texas (B. M. 841a); French Guiana (Paris Herb.); Brazil (Paris Herb.).
3. **L. conicum** Pers., Syn., i., p. 159 (1801). Plasmodium rose-red, in rotten wood (testa Dr. Rex). *Æthalia conical, sessile on a broad base, crowded or scattered, 1·5 to 3 mm. high, 0·8 to 1·5 mm. broad, sometimes subglobose, yellow-brown; the dark confluent superficial vesicles forming spots or a broken reticulation, chiefly on the upper part; cortex thin, of two closely combined layers, the outer traversed by flattened threads 2 to 10 μ broad, either loosely interlacing, or more often nearly parallel in a single series, and separated by intervals of 2 to 20 μ, piercing the membranous inner layer and continuous with the capillitium. Capillitium of simple, rarely branching, olivaceous-grey threads, 3 μ diam., or varying from 2 to 7 μ, faintly and minutely wrinkled, with clavate or obtuse ends. Spores, in mass, yellowish-grey or ochraceous, minutely reticulated over the greater part of the surface, 4 to 5 μ diam.—Fries, Syst. Myc., iii., p. 82; Mass., Mon., p. 123. **Dermodium conicum** Rost., Mon., p. 284.

Plate LXXXVI., A.—*a. æthalia, × 20; b. part of cortex; (1) outer membranous layer, bearing on the surface irregularly shaped vesicles containing dark granular matter, traversed by empty flattened tubes, having a somewhat parallel arrangement; (2) homogeneous inner layer, perforated by the narrow capillitium tubes, × 180; c. part of capillitium tube, and spores, × 600 (Ohio, U.S.A.).

This description is taken from specimens received from Dr. Rex under the name of *Dermodium conicum*, and from Mr. Morgan under the name of *Lycogala conicum*; they were gathered in Fairmount Park, Philadelphia, and at Preston, Ohio. They differ from *L. minutum* in the uniformly small size and more or less conical shape, in the scanty seldom branching somewhat parallel threads in the thin outer layer of the cortex, and in the almost simple threads of the capillitium; very similar structure is met with, however, in minute thin-walled æthalia of *L. minutum*, showing the close alliance of the two species; but such small æthalia of *L. minutum* are usually found in company with others of more ordinary dimensions, and differ in shape and in the arrangement of the warts from the American specimens. The type specimen of *L. nitidum* Berk. & Br., from Ceylon (K. 1729), is referred to by Rostafinski as being *Dermodium conicum* (Mon., App., p. 37); the cortex is thin, and traversed by broad and narrow threads, more interwoven than in the specimens from America; but the æthalia are hard and immature, and are valueless in the determination of specific characters.


**SPECIES NOT MET WITH IN THE QUOTED COLLECTIONS.**


**Hab.** On rotten decorticate branches.—Malacca.
SPECIES EXCLUDED FROM THE MYCETOZOA.

*L. rufo-cinnamomeum* Mass., Mon., p. 125, from S. Africa (K. 1735), has the cortex on the peridium, consisting of a dense uniform tissue of hyphae, in which occasional septa are to be seen; the spores are dark brown, warted, 5 to 7 μ diam., often showing a short stalk.

*L. ochraceum* Mass., Mon., p. 125, from Java (K. 1737), consists of a mass of branching hyphae, bearing numerous pale warted spores 3 μ diam.
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BADHAMIA HYALINA Berk
BADHAMIA UTRICULARIS Berk.

BADHAMIA MAGNA Peck
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PHYSARELLA MIRABILIS Peck
CRATERIUM PEDUNCULATUM Trent

CRATERIUM CONCINNUM Rex
CRATERIUM RUBESCENS Rex

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CHONDRIODERMA FLORIFORME Rost.
a—d CHONDRIODERMA HOOKERI List.

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Pl. XXXVIII.

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B

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A

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B

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f
g

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A

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B

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Lister pinx.
ARCYRIA VERSICOLOR Phillips

ARCYRIA ALBIDA Pers.
A

Pl. LXVIII.

A

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c, d ARCYRIA INSIGNIS Kalchbr & Cooke

B

Lister pinx.

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